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Among the Finalists for the American Machinist Awards for 1931

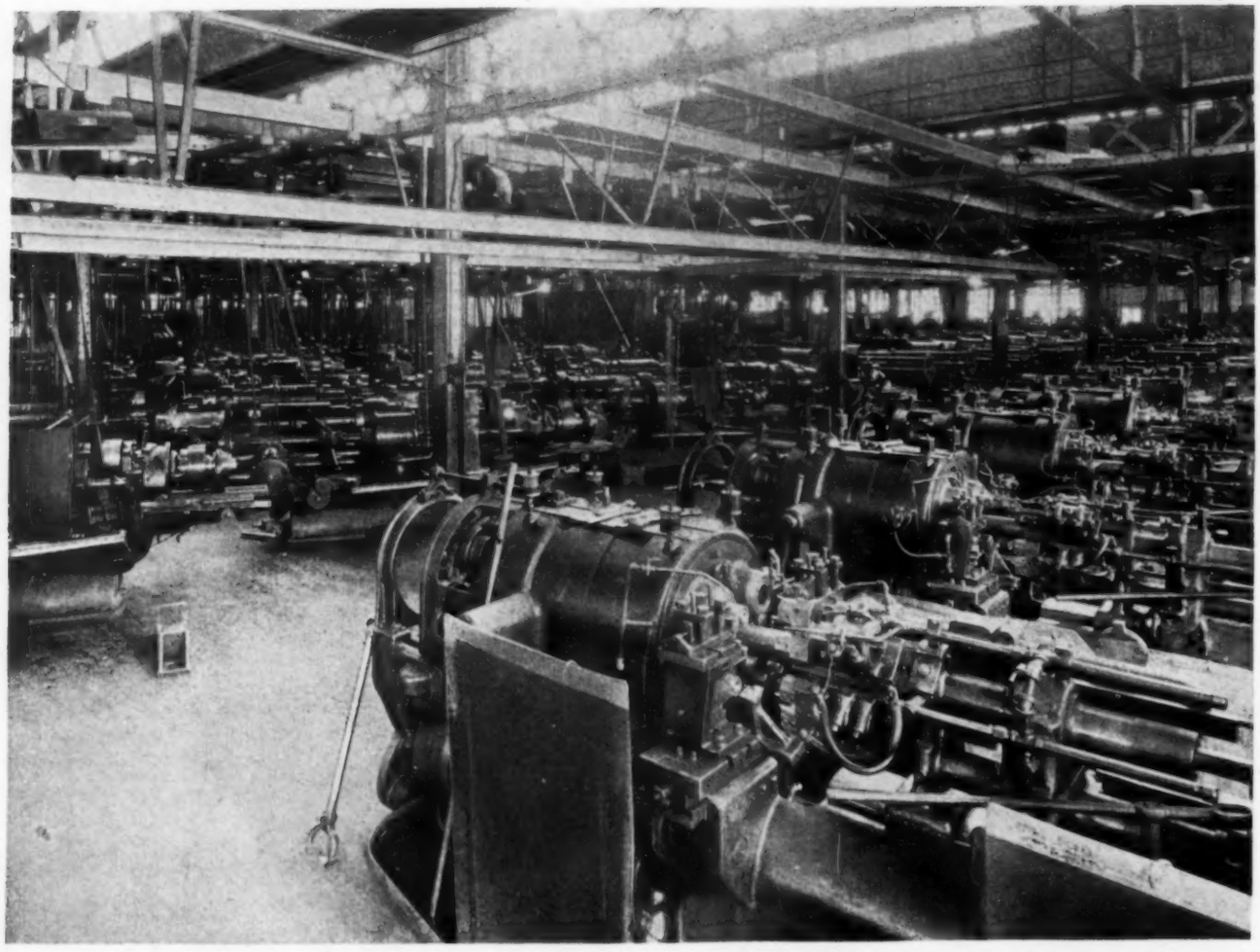
$$M = \frac{C_e + C_t + V_b}{(R_p - R_e) \times N_d \times D_m - T}$$

It will be remembered that when the winners of the *American Machinist* Awards for 1931 were announced on November 12, it was stated that the Committee on Awards recommended six briefs for publication in addition to the winners. When publication of all eight will have been completed, it will be found that each and every one of them approaches the problem from a different angle; yet each company employing its given policy has found success.

Rather than unfortunate, this may be the best of good fortune. Every metal-working manufacturer, unique in his given line, may be enabled to find an equipment replacement plan to fit his requirements without undue alteration.

Certain members of the Committee were impressed with the universality of the S K F Industries, Inc., plan as presented under the title, "Replacement by Formula," on the following pages. As its author, Mr. Runge, states, the S K F Equipment Replacement Policy is based wholly upon the familiar replacement formula reproduced on this page. For ten years his company has worked with it continuously and consistently until the three S K F plants have more than doubled their production per square foot of floor space.

How they have at the same time improved quality is a story in itself. At the Atlas Ball plant, for example, the operatives think nothing of maintaining tolerances of 0.00005 in. in sphericity and diameter. At the Skayef and Hess-Bright plants, the operatives hold bearing ring tolerances between 0.0002 and 0.0006 in. The whole story will be found in Mr. Runge's informative statement.



Automatic department at SKF Hartford plant; Skayef Ball Bearing Company

Replacement by Formula

R. F. RUNGE
Vice-President,
S K F Industries, Inc.

Through its consistent equipment replacement policy, SKF Industries, Inc. has more than doubled its production per square foot of floor space and at the same time improved quality

Brief entered for the *American Machinist* Award for 1931, Class I, and selected by the Committee on Awards for special consideration and publication.

AS AN introduction to the following facts concerning SKF equipment replacement policy, it may be well to outline the general set-up of the organization in the United States. SKF Industries, Inc. is located in New York City, from which office all financial, advertising, legal, sales and sales engineering activities are handled. This work is carried on in cooperation with the three manufacturing plants—two located in Philadelphia and one in Hartford.

As replacement policy may vary according to industry and class of product manufactured, it may be in order to outline the general activities of the various SKF factories. At the Hess-Bright Manufacturing Co., Philadelphia, the products manufactured are spherical (self-aligning) roller bearings, single-row deep-groove ball bearings, and double-row radial and angular-contact deep-groove ball bearings, as well as single-row angular-contact ball bearings. At the Atlas Ball Co., Philadelphia, all the ball requirements of SKF Industries are produced, also sales of balls are made to the general consuming industries, including balls made of special materials such as Monel Metal, stainless steel and bronze. At The Skayef Ball Bearing Co., Hartford, self-aligning double-row ball bearings, cylindrical roller bearings, and various types of standard and special cast iron, cast steel and bronze housings for various types of bearings, including standard lines of pillow blocks and line-shaft hangers, are manufactured. In this latter department facilities are available for the manufacture of small housings weighing only a few ounces up to large rolling mill boxes and railway journal boxes to a weight of over one ton.

Those familiar with the manufacture of anti-friction bearings will realize that all operations entering into bearing construction are accompanied with requirements

for close precision tolerances, thus calling for equipment that will not only produce parts at low cost but which also must be of high precision character. Illustrating the standard of precision—it is everyday practice in the Atlas Ball plant to produce steel balls within a tolerance of sphericity and diameter of 0.00005 in. In the manufacture of bearing rings at Hess-Bright and Skayef, the tolerances applying to the more popular ranges of bearings are from 0.0002 to 0.0006 in. In addition to close tolerances, extremely fine finish is necessary, especially in connection with the balls, rollers and grooves in the rings, in which the rolling elements are contained.

As a result of improved machinery, both tolerances and finish have seen yearly improvements, so that, as a result, we have today more smoothly operating bearings, and on approximately 70 per cent—as related to individual operation — tolerances maintained are approximately one-half of the published bearing tolerances. Likewise, the fatigue life of the bearings over the past five years has been constantly increased, giving users a definitely lower cost per hour of operation than has previously been achieved.

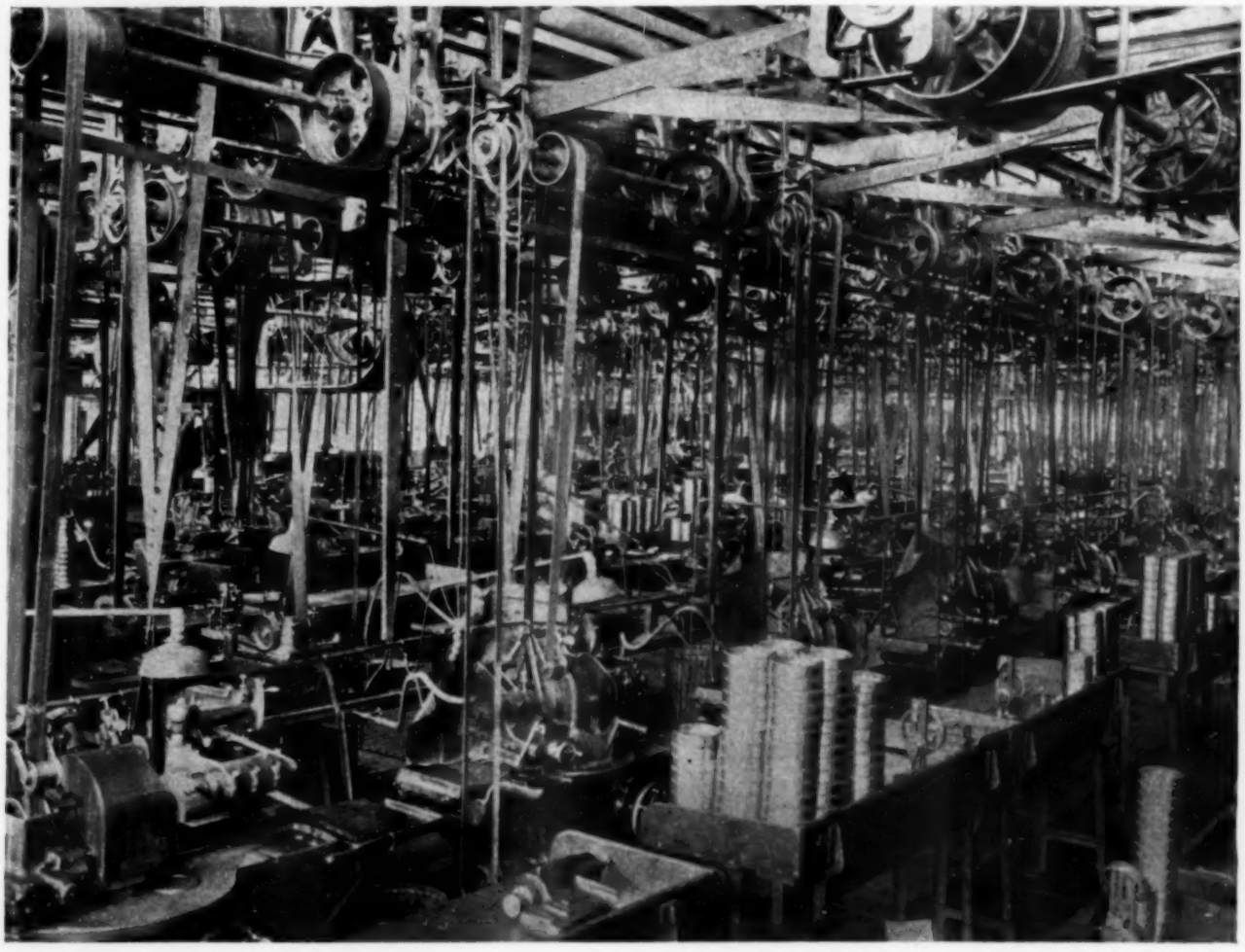
The result of the SKF replacement policy, which has been in effect for ten years, has been a definite improvement in quality of product at constantly decreasing costs, giving to the purchaser bearings having longer fatigue life at constantly decreasing selling prices, practically paralleling decreases in cost of manufacture. Obviously, improved equipment is not entirely responsible, for improvement in materials, heat-treatment and methods of operation have also played their part. A point of interest in this connection is that approximately 28 per cent of all the productive manufacturing equipment in all SKF factories has been in use ten years or longer, although the company has been engaged in manufacturing for a period of 25 years.

A definite method of procedure for machinery replacement eases the question of earlier days as to when a certain piece of equipment should be replaced. The old hit-and-miss methods have been replaced with a more modern plan which has proved satisfactory. The factory manager is responsible for knowledge of new and better equipment. It is the planning division's responsibility to make a preliminary investigation of the machine through personal inspection and data furnished by the builder.

It may be said here that, as a matter of policy, when a more efficient machine is discovered, replacement of the old equipment takes place gradually. A sufficient number of machines—after a first machine has been thoroughly tried out and proved—are purchased to take care of normal production requirements. The reason for this consideration is that should a still better machine be developed—either by the Company or by someone else—there is greater leeway to take advantage of the newer improvements more frequently.

The purchase of replacement equipment by formula

Grinding room at one SKF Philadelphia plant, the Hess-Bright Manufacturing Company



Equipment Replacement—SKF Industries, Inc.

Equipment	Automatic Bore Grinder vs. Plain Bore Grinder	Automatic Bore Grinder vs. Plain Surface Grinder	Centerless Grinder vs. Plain Grinder	New Type Oscillating Grinder vs. Old Type Grinder	Milling Machine vs. Engine Lathe	Automatic Chucking Machine vs. Turret Lathe
M = Number of months in which new equipment will pay for itself through savings.	17.62	17.3	20	20.9	8.9	23.03
C_e = Cost of new equipment installed	$6,395.76	$9,159.33	$6,812.29	$1,892.99	$4,100	$3,414.34
C_t = Cost of tools, jigs and fixtures required to operate new equipment	137.40			55.77	$1,655	652.87
V_b = Book value of displaced equipment minus second-hand or scrap value realized	No value	No value	No value	No value	No value	No value
R_p = Material, labor and overhead cost per piece on present equipment	0.0981	0.138	0.0768	0.0619	0.05263	1.075
R_e = Estimated material, labor and overhead cost per piece on proposed new equipment	0.0732	0.135	0.0700	0.0476	0.04100	0.968
N_d = Number of pieces to be produced per day by the proposed equipment	810	9,600	2,742	359	2,880	92
D_m = Number of working days per month	20	20	20	20	20	20
T = Interest per month on net investment, at the rate of 6% per annum	32.67	45.80	34.06	9.74	28.775	20.33
$M = \frac{C_e + C_t + V_b}{(R_p - R_e) \times N_d \times D_m - T}$ =	17.62 months	17.3 months	20 months	20.9 months	8.9 months	23.03 months

has been found to be very satisfactory. Obviously, a complicated formula could be developed, but it is most desirable to have as simple a formula as possible—taking into account only those elements which have greatest influence on the result. Therefore, the following formula has been used for many years and is one which is understood by any division of management whose responsibility it is to approve the purchase of new equipment:

$$M = \frac{C_e + C_t + V_b}{(R_p - R_e) \times N_d \times D_m - T}$$

Equipment Replacement Formula

The meanings of the terms employed are as follows:

M = The number of months in which the equipment will pay for itself through savings.

In considering the advisability of the purchase of replacement equipment, two years has been generally set as a satisfactory period to accomplish the return of the additional investment. This is considered in hours of operation for regular day shift work. If during that period extra hours of work are required, such as night shifts, then the machine will pay for itself in a relatively shorter time, and, on the other hand, in case of business depression where the machine must stand idle over comparatively long periods, it will take relatively longer for the machine to pay for itself. Over a period of years of operation it has been found that the average time is from two to three years.

C_e = The cost of the new equipment installed.

In this cost is included all transportation charges, as well as cost of foundations and installation.

C_t = The cost of new tools, jigs and fiixtures required to operate the new equipment.

V_b = The book value of the displaced equipment minus second-hand or scrap value realized.

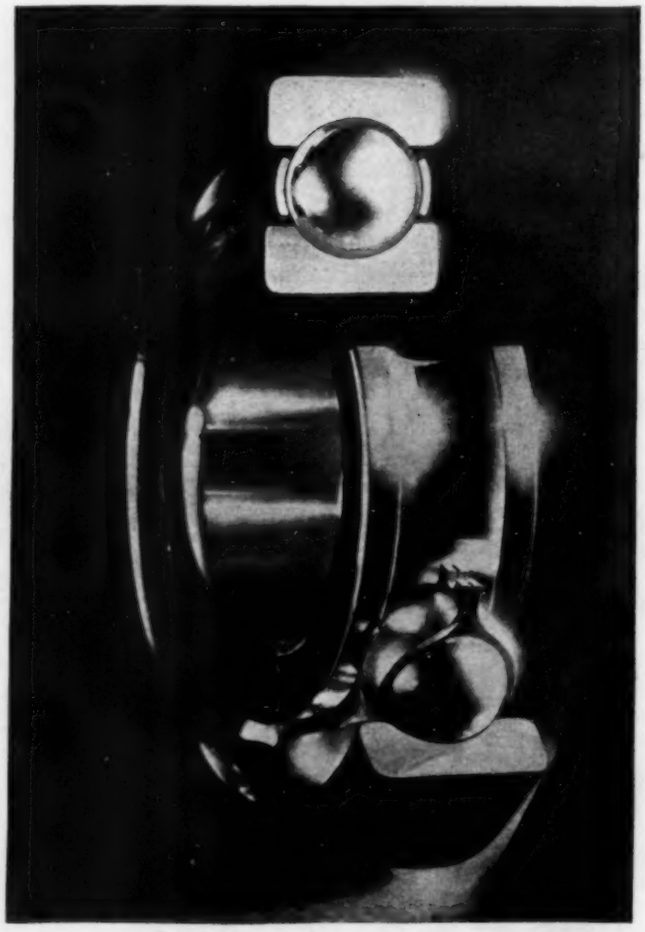
The amount represented by this item can be considered as obsolescence.

R_p = The material, labor and overhead cost per piece on present equipment.

R_e = The estimated material, labor and overhead cost per piece on proposed new equipment.

It will be noted that raw material has been included in the cost per piece for items R_p and R_e. That is for the purpose of drawing specific attention to cases where the new equipment may require more or less material for the same production of pieces. This may involve not only raw material, but the matter of increased or decreased scrap must also be considered.

The proper application of overhead, especially to the new machine being considered, can become decidedly complicated. As it is difficult in many cases to determine what the overhead will actually be on the new



One of the many types and sizes of SKF bearings

machine, the application of departmental overhead to both the new and old machine may safely be taken as a basis, and the main items of difference then would be in the amount of depreciation, floor space required and such other important items as may apply to the specific type of equipment under consideration.

Maintenance on the new machine, tools and resulting idle time is something practically impossible to determine until sufficient experience has been had in the actual operation of the machine. Machinery builders, as a whole, have given little attention to this subject. It, nevertheless, should play an important part in any machinery sales discussion, and it is desirable that the machinery builder have a better knowledge of what may be generally expected from his machine in the way of maintenance. This item, to be sure, is subject to many variables, but is one on which the machinery builder could undoubtedly obtain some satisfactory average figures, provided the builder makes proper contacts with the users of his equipment on a mutual basis of confidence.

N_d = The number of pieces to be produced per day by the proposed equipment.

D_m = The number of working days per month.

T = The interest per month on the net investment.

This item is subject to argument, but from a financial point of view the interest charge has some appeal, especially if it is necessary to borrow the money or to sell securities in order to purchase the new equipment.

Aside from the dollar advantage in the purchase of new equipment, consideration must also be given to possible improvement in accuracy or finish of the product. There is also the possibility of improved working conditions for employees, and while both of these have intangible value, their proper consideration will many times decide the purchase of new equipment.

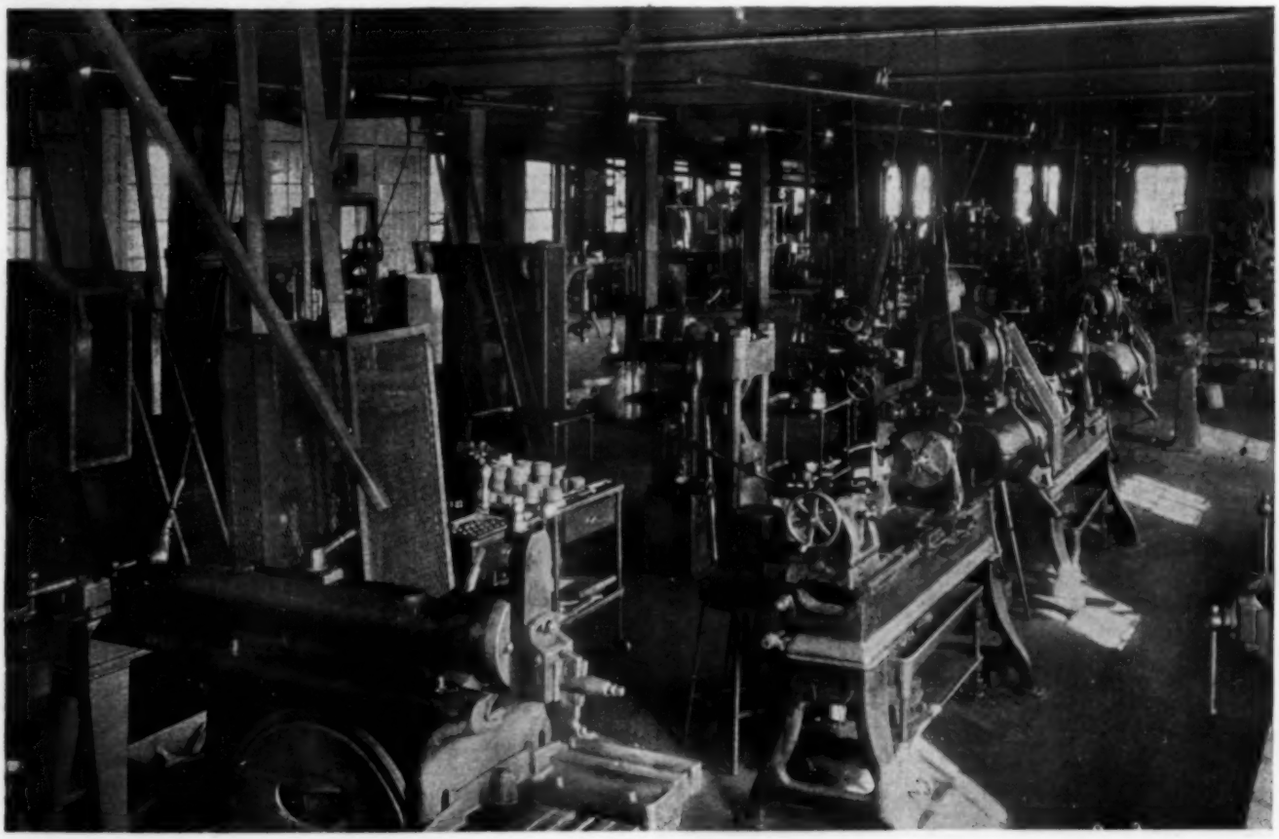
The above formula may be used for practically any type of machinery. It has been applied to the purchase of shop conveyors, the installation of oil burner equipment for plant heating and many other miscellaneous equipment items. The point should be stressed again that in the development of a formula, special effort should be made to keep it as simple as possible and not to burden the consideration of the more important items with the innumerable detail items which have little or no bearing on the final result.

When a new machine comes to the attention of the factory planning division, the builder's claims for its performance are investigated, and if all of the items in the formula compare favorably, the factory manager is presented with a formula sheet indicating the number of months it would take to pay for the new machine as compared with the present or old equipment. Several actual cases wherein the machines have paid back the additional investment in less than two years are shown in the table on the opposite page.

When the factory manager has satisfied himself as to all phases of the desirability of purchases of the new equipment, his formal request is then submitted to the New York Office in the form of a special expenditure authorization. This sheet is accompanied by the formula sheet, and if no further information is required by the vice-president, the request is either approved or rejected, depending on sales conditions, cash on hand, and similar considerations.

Where the machine under consideration is entirely new, arrangements are usually made to put one such machine into the factory on trial. The supervision of

Machine shop at still another SKF Philadelphia plant, Atlas Ball Co.



that machine during this trial period is directly under the company factory planning division, which checks both the definite and assumed figures given in the formula and, on that basis, gives the final approval or rejection.

The results of the SKF replacement policy are generally outlined in the introduction of this paper. It, however, has had one other influence of major importance—with the improvement in productive equipment, the increase in factory floor space has been materially minimized relative to increased production, which has resulted in large savings in building costs. This is shown by the following tabulation:

Production Per Sq. Ft.

	Number of Finished Bearings	Weight of Finished Bearings, Lb.
1921	11.1	22.2
1926	19.7	26.6
1931	26.6	34.6

The above figures are true ratios of the actual increase of unit area efficiency. These figures are based on the complete factory area, including both productive and non-productive departments. Should only productive departments be considered, then the increase in each of the five-year periods would be considerably greater.

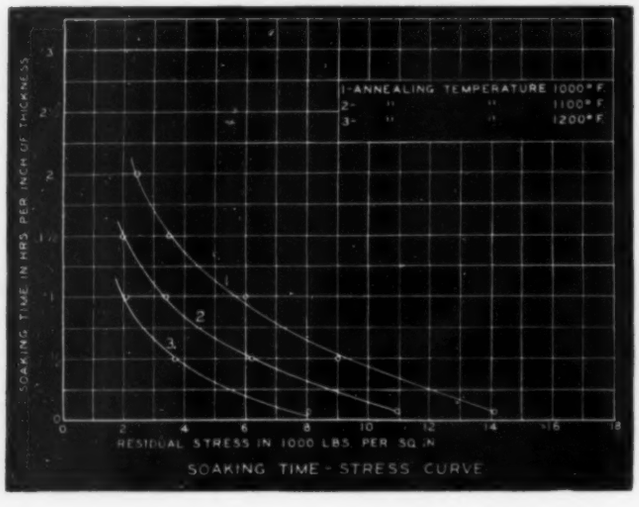
In the past several years there have been a number of machine builders who, through rapid improvement of their products, have made obsolescence the major consideration in replacement of equipment. This might be more generally accomplished if all builders could make greater efforts toward yearly improvements, so that the accumulation of all improvements over any five-year period would produce machines sufficiently better than machines of five years previous. In other words, improvements should permit the above formula to show that the new machine will pay for itself within two to three years. The machine user could then write off an amount equal to 20 per cent of the machine value per year. Such a program would increase the progress of the machinery building industry, help in the stabilization of employment and further decrease the cost of the finished article to the consumer.

Relief of Welding Strains by Annealing

With his American Welding Society paper under the above title, Charles H. Jennings, research engineer of the Westinghouse Electric & Mfg. Co., included this convenient "Soaking Time-Stress Curve" chart. It gives, for any given annealing temperature, the soaking time necessary to reduce final residual stresses in a structure to a given minimum.

The maximum allowable residual stress in a structure and the annealing temperature will often depend upon the article itself and the facilities for annealing. It should be borne in mind that the higher the annealing temperature, the greater is the possibility of warping. As a result, in some cases it might be advisable to anneal a structure at 1,000 deg. F., and allow it to soak for 1½ hr., per in. of thickness in order to reduce the stress to 3,000 lb. per sq.in., rather than to anneal it at 1,200 deg. F., and to soak it for ½ hr. per in. of thickness.

When strain annealing, it is not essential that the yielding take place in the welds. Yielding of the parent metal is just as effective in relieving residual stresses.


1-ANNEALING TEMPERATURE 1000° F.
2- " " 1100° F.
3- " " 1200° F.
SOAKING TIME IN HRS. PER INCH OF THICKNESS
RESIDUAL STRESS IN 1000 LBS. PER SQ. IN.
SOAKING TIME - STRESS CURVE

It is also well to mention that the test specimens were annealed under laboratory conditions and that the time expended in heating and cooling the specimens was relatively small. In production where the annealing furnaces are large and the temperature change slow, the heating and cooling cycles may in effect increase the soaking time. This factor, however, is on the safe side and induces an added factor of safety in that the resultant stresses will be below the values given by the curves.

The results of this investigation were obtained from specimens stressed in direct tension and compression. The possibility of obtaining different results with specimens subjected to bending stresses is recognized and will warrant further investigation.

From the results of these tests, the following conclusions on strain annealing of welded low-carbon steel structures can be drawn. (1) Welding strains and residual stresses can be reduced by annealing at temperatures below the critical point of the material. (2) The effectiveness of annealing in reducing welding strains depends upon the annealing temperature and the soaking time. (3) In order to obtain a given minimum residual stress, the higher the annealing temperature, the shorter the soaking time required. (4) By proper annealing, residual stresses in welded structures can be reduced to a few thousand pounds per sq.in.

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Machining Duralumin—*Correction*

It would appear from the text (*AM*—Vol. 75, p. 269) that the reported laboratory tests on the machining of Duralumin were made by the Aluminum Company of America. The facts are that the material in both cast and wrought form was furnished by the company, but the tests were conducted under the auspices of Ohio State University Engineering Experiment Station and the Department of Industrial Engineering by John Younger, professor of industrial engineering, and W. R. Jenkinson, research student.

Twice-Used Heat

J. B. NEALEY
American Gas Association

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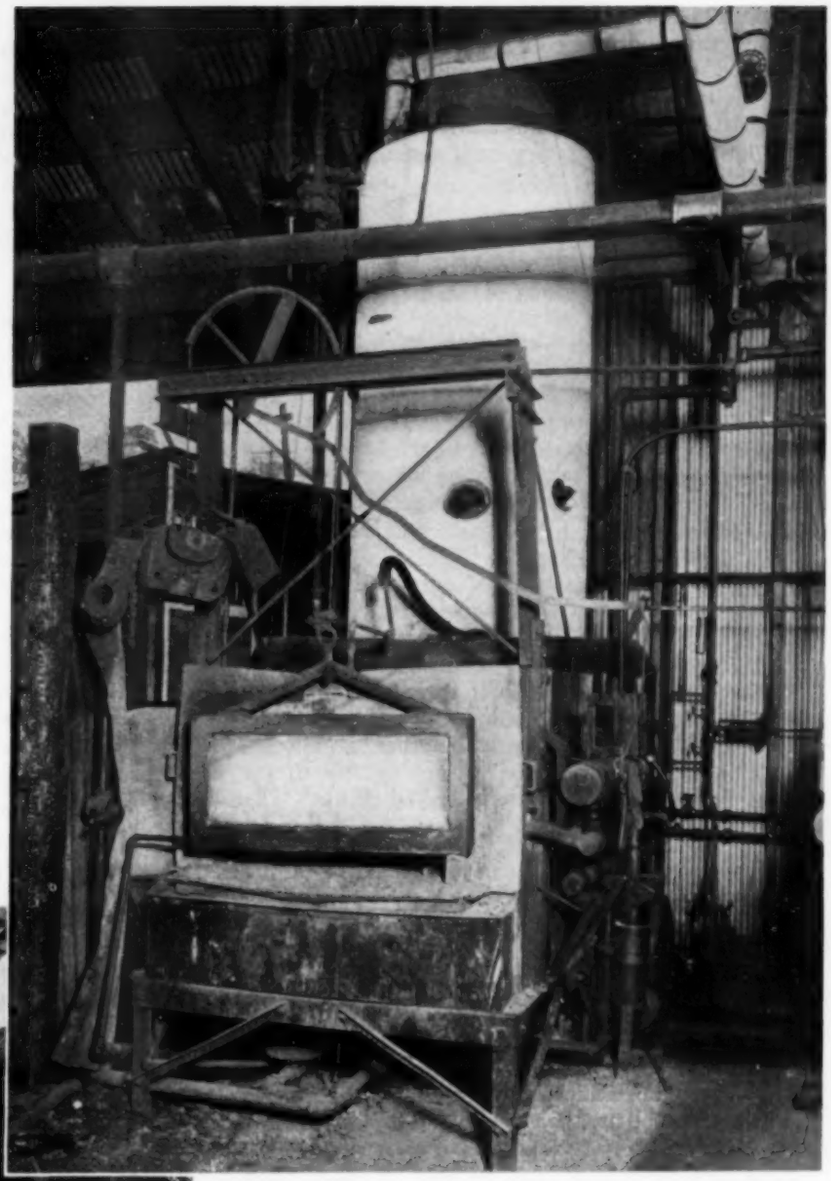
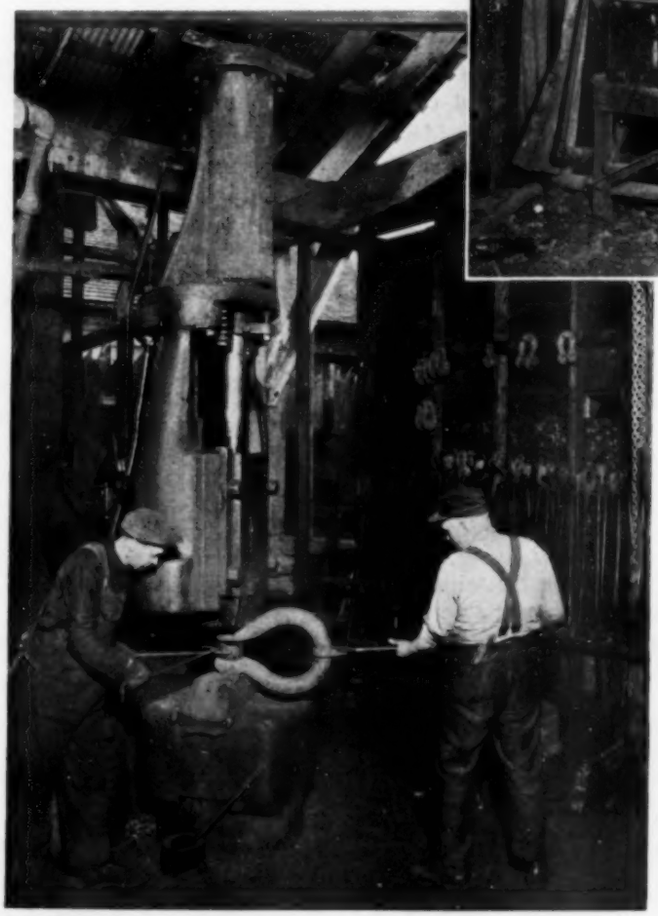


One of two gas-fired combination forge furnaces and vertical tubular steam boilers used by the Skookum Company, Portland, Ore., to operate a trip and two steam hammers, one of the hammers being pictured below. The combination reduces heating and steam power costs by 22 per cent. The boiler firebox nests into the upper furnace wall, waste heat flowing through an opening into the boiler firebox. Careful arrangement provides heat balance between units



EACH 3x4-ft. furnace, by this plan, is heated with six staggered gas burners, three on a side, firing tangentially against the arch, the boiler being provided with an auxiliary burner. The gas-air mixture for the furnace is reducing to minimize scaling, an excess of air being provided through the auxiliary burner to prevent smothering of the boiler burner flame. A steam pressure control which regulates in turn the volume of fuel to the auxiliary burner and three of the furnace burners provides automatic operation. This is done in two stages, the first consisting of a steam control valve in the bypass air line, the valve being held open by a spring against the steam pressure. When steam pressure rises above the point set on the control index, it forces the valve shut, shutting off the air supply. The bypass line runs between the main air supply line and the diaphragm-operated valves in the air and gas lines to the burners. Air pressure from the bypass to one side of the diaphragms keeps the valves open and the burners firing. When steam pressure rises too far, the closing steam valve cuts off the air pressure, which in turn allows the diaphragms and their valves to close the air and gas flow to the burners. A water regulator and steam water pump added to the boiler complete the automatic set-up. A steam accumulator inserted in the line might conceivably reduce the cost for steam power some 25 per cent.

EXECUTIVE

Stockholder vs. Employee

When company earnings diminish someone must suffer. Two groups are directly interested and affected—the stockholders and the employees. Not long ago, the duty of management seemed clear cut. Company executives were regarded as the tools of the stockholders, employed to promote operating efficiency, which then meant maximum profit. In the last few years, a new viewpoint has modified this idea. Employees are now considered to have some claim upon the company. How strong is this claim as compared to that of the stockholders? Which group should bear the brunt of declining profits? If you were president of the Mid-City Machine Works, what would your report recommend? What do you think about this executive problem?

A STATEMENT of earnings upon his desk absorbed the attention of George B. Coakley, President of the Mid-City Machine Works. Evidently it was not to his liking. Frowning, he made check marks with his pencil after this item and that. This process was interrupted by his secretary who announced a visitor, Mr. William Holland.

"Sit down, Bill," said Coakley when Holland was ushered in. "You're just the man I want to see. If ever I needed sound advice, it's now."

Bill smiled. "Glad to help if I can."

"Here's the problem," said Coakley. "We won't earn our dividend during the last half. It's time for me to prepare my annual report to the board of directors and recommend what's to be done. It's one of two things—either we'll have to cut wages and salaries or pass our dividend."

"An uncomfortable position," agreed Bill, "but not unusual. Haven't you cut wages already?"

"Yes," said Coakley, "ten per cent last January. We also cut our dividend rate in half at the same time. But now we're not earning the reduced dividend. So we're forced to go further one way or the other."

"How about your surplus?" asked Bill. "That's still intact, isn't it?"

"Surely, but we can't weaken our position by digging into our surplus at a time like this."

"That's one trouble with a lot of you fellows," said Bill. "You build up reserves to tide you over periods of depression, but when the time comes to use them, you're afraid to do it. You talk about distributing profits on a five- or ten-year basis but instead you get conservative and decide to preserve your assets. Well if you must do that, then pass your dividend."

"But why not reduce wages instead?" asked Coakley. "Some of our competitors have made greater cuts. Our employees are glad to have their jobs and won't kick."

"You mean it's justified as long as you can get away with it," said Bill. "Well you asked my advice, and I say your wage cutting has gone far enough. Most of your employees are dependent on their pay. Most of your stockholders have other sources of income. You'll hurt purchasing power to a greater degree by reducing wages than by dropping your dividend."

"But I'm working for the stockholders," said Coakley, "not the employees. This is a commercial enterprise, dependent on earnings for its existence, not a philanthropic institution. My efficiency as president is largely measured by my ability to maintain company profits. And the only way to do that now is to decrease labor costs and office overhead."

"I understand what you're up against exactly," said Bill. Your directors are heavy stockholders and loss of dividends will hit them right in the pocketbook. If you go before them with a lot of figures on lowered costs of living and competitive policies, they can vote a wage cut with eased consciences. Then you'll issue a statement saying the board has decided on a pay cut. That lets you all out the simplest way. But remember you're not working for the stockholders alone. The company owes just as much to those who have given the work of their heads and hands to its upbuilding as to those who have given their dollars."

"Bill, you sound like a sentimental idealist instead of a practical business man."

"That may be," said Bill. "But business today must take a new view of its responsibilities."

FORUM

Discussions Of Former Subjects

Self-Contained

We have learned through expensive experience it does not pay to try to cover all our auxiliary activities. At one time, we generated our own power, and as the power plant was not large enough to have an engineer in charge, we soon developed into power plant experts instead of tending to our own specialty.

It was the same with steam heat, electrical work, trucking, and other items. Every $5.00 job cost us about $100.00, as all the executives would pass on each problem. Since contracting these auxiliaries with specialists, we can stick to our own last, and not only save money on our repairs but make more profit in our business.

—U. Seth Eberhardt,
Works Manager,
Newark Gear Cutting
Machine Company.

Auxiliary activities are best left as a plant activity, rather than let to outsiders on a contract basis. Despite the excellence of the arguments that may be marshalled in favor of the contract system at the present moment, I would offer as counter arguments the fact that when production resumes its normal stride, contract service is likely to suffer correspondingly and that the business of negotiating contracts may prove more difficult than the intelligent scheduling of one's own men. It must be borne in mind that a good contract must be specific, and the drawing up of specification clauses for such a contract is no mean task, both in the time consumed and the experienced ability required.

It is admitted that a large undertaking, such as the painting of the entire exterior of the plant, might be handled advantageously on a contract, but it must be realized at the same time that such a job in the plant maintenance department provides an excellent fill-in job to more urgent activity. You can't profitably let major jobs all on contract, and then balance your own force for the more urgent internal jobs.

Under present conditions, there is one alternative not mentioned in the discussion, which I believe can be utilized as a profitable expedient. That alternative is to put all maintenance work, which is applicable, into one's own production shops on regular schedule. For example, suppose the maintenance department requires a lot of special sheet metal fittings for a certain job that is not an emergency and that there is a sheet metal production shop available —then why not let this shop do the job? This will cut down the strictly maintenance force, and at the same time keep the work where it is fully controllable. —Earl L. Fairall,
U. S. Naval Aircraft Factory.

Marking Time

During any period of depression and stagnant buying, there is one important phase of the machine-tool business which should not be overlooked. This is the work of the engineering and designing departments in the redesigning and new designing of machines for future sales.

Every progressive manufacturer is always striving to bring out better and new machines for constantly arising new uses. During a period of depression, there are many manufacturers who curtail their forces to such an extent that even new design work must be held up. Their viewpoint is that it is easy to allot money for experimental purposes when the profits are coming in and that it is even easier to omit this work during hard times. Another reason for a slackening of experimental work is caused by the gradual change in the policy of the older firms which have done their pioneer work in earlier days and have turned their energies to manufacturing problems.

Conditions at present have two opposing effects on the sale of new machines and methods. New competitive conditions require the use of absolutely the best and latest, while on the other hand, financial conditions preclude too extensive a change in methods of manufacture or in installations of new machines. The new methods must be so radically different, so fundamentally sound, and so easily recognized as such that the prospective customers will readily see the wisdom of a change in their methods in spite of hard times.

To aid this pioneer work, there are changed conditions in the field which make possible the adoption of new machine methods. These are briefly —first, the need of meeting stronger competition than ever before; second, the creation of a demand for new methods caused by changed processes developed during high peak production; third, the willingness of manufacturers to try out anything which might better their condition.

Young firms thus have an opportunity to get their ideas into action while the older firms, that have been manufacturing standard lines for years, have a splendid opportunity to try their experiences and energies to the development of new machines and should not be so content with their supposedly perfect standard line as not to be willing to experiment. In the recovery of business after any serious depression, those firms which have developed new machines or methods have been the first to return to normalcy, and those firms which have adopted the new methods have been leaders in their particular line. The amount of time required to bring out new machines necessitates as early a start as possible and the first step, planning, which is an engineering function, should be undertaken without delay. To stand still in any enterprise is to slip backward.

—Deane S. Hazen,
Industrial Counsel.

One Line or Many?

With the highly competitive machine tool field today, specialization has become a guarantee to the prospective buyer of high standards of quality, efficiency in the machine, and the organization backing it.

Unless the design of a new machine incorporates a really radical change or changes which will cut machining costs even lower than its competitors, and so create a demand, the chances of even mediocre success are problematical and not worth risking the time and money which must be spent. The reputation of the company is bound to suffer if the new product fails even to reach mediocrity, with

an inevitable reaction which affects the sales of the product on which that reputation was built. I could cite several instances in which concerns have emerged considerably poorer and with lessened prestige through ill-starred ventures of this kind. Manufacturers would be well advised to concentrate their abilities along lines with which they are familiar; if they can make a good product better, the sales situation will take care of itself.

—Robert S. Alexander,
Universal Winding Company.

One Line or Many?

When a plant is working at a much reduced capacity this automatically increases the percentage of overhead costs. If it decides to manufacture other lines along with the present one, the extra costs involved will be modified by the increased output, causing a reduction in the percentage of overhead costs. Suppose we divide the works in such a manner that we have sufficient facility for the present line, and note the reduction in manufacturing costs. The remainder of the works is now standing idle and is a dead loss which must be borne by the product, thereby increasing its cost. This superfluous part of the works holds possibilities of easy conversion to suit new lines.

Why should we not found a new business distinct from the present one, but composed of the unwanted part of our present business and working in sympathy with it? The capital represented by this part of the works is of no use at present and would be far better employed in some new venture, instead of dragging our present product into disrepute.

Under these circumstances we only need consider the relative merits of each new line, which could employ profitably the surplus space, or at any rate a part of it.

—A. W. Marsden,
Rochdale, England.

Hours Gratis?

In practically all industrial plants, the salaried personnel works longer hours now than the shop man. Occasional overtime seldom meets with objections. The pernicious habit, however, of asking salaried men to work continual periods of overtime without pay cannot be too strongly condemned.

Executives who participate in yearly bonuses need no consideration in the matter of overtime. The great rank and file of salaried men should be hired on a predetermined basis—say, for example, a fifty hour week. Hours worked beyond that period should be paid for at a rate agreed on when the employee is engaged. This will tend to exert a pressure on management to plan ahead and eliminate the need for overtime. There are exceptions, of course, but most of use can trace the cause of the overtime to some definite department that slipped on the job. The banker, who finances a company, allows no overtime on his loans. Time is the capital of all men. Men should not be robbed of it without pay.

—James K. Matter.

Shirt Sleeves or White Collars?

I worked on the bench with an excellent workman, ambitious and tireless. He went in business for himself. Long hours, conscientious work, creative ability, and eventually, he had a substantial business and bank balance. During this period, his time and shop were devoted exclusively to jobbing work. But the manufacture of some product, in the cradling age appealed to him. He entered this field of slight competition, and expanded rapidly, as his product was an accessory to an important unit that the public hungered for.

During these years he was the shirt-sleeved man wearing the white collar. And his shirt-sleeved associates, that had grown with him, wore white collars. Overnight, he left this character behind. A new engineer had been added to the organization, a brilliant mathematician, a student of many universities, well diploma'd and a convincing talker. And in a surprisingly short time, every move was engineered and directed by this power behind the throne. Fixtures, tools, dies, and methods were found to be theoretically wrong. New departments and new faces appeared, and charts almost the size of box cars appeared in screw machine, press room, assembly room, and other departments. And these charts were plotted, time limits specified, deliveries scheduled. In fact, according to the white collars directing this scheme floating a boat down a smooth river was rough going, compared to the manner production would now flow. And the old associates were on the receiving end of the charts and instructions. They resented, and objected to immature and impractical directions. Costs mounted, and piece rates were cut. And still costs mounted. Finally, the owner was convinced that his old associates were obstructionists, that they were deliberately failing in cooperation, and with sincere regret they were gradually dropped, for the good of the organization.

The owner is retired now. Facing a crisis, and having nothing but alibis and expenditures suggested by his new organization, as reasons for continuous heavy losses, he used his original hard-headed common sense and sold to a competitor. The house cleaning was thorough; the brilliant mathematician and his cumbersome organization were promptly fired. Key positions were placed in the hands of competent men. The product of the engineering office was examined, criticized or commended as the practical saw it, and the practical man's opinions were engineered and developed in a cooperative spirit.

Both shirt sleeves and white collars are required, each in proportion to the actual need of them. The president should look beyond the collar and into the character, and ability of the parties wearing them. And as a pillar to lean against occasionally, have the shirt-sleeved executive, wearing a white collar, right close to your elbow.

—John J. McHenry.

Does Frankness Pay?

A man's actions generally depend on the exact circumstances surrounding him. If he is on terms of such intimate understanding with his chief as to be certain of unbiased advice and assistance or if he knows the position of the company to be such that his chief would welcome a reduction of staff, then he may be wise to proclaim his intentions. These conditions are rare. It is wiser to prevent one's intentions from becoming known.

A company may appreciate frankness on such a topic, but its reaction to such information may be very unpleasant and quite unnecessary. As long as a man carries out his present duties conscientiously and fulfills the terms of his contract, he is quite at liberty to consider any other employment he desires. How few are the chiefs who can view with complacency the loss of a good right-hand man without hindering his departure?

—Peter Hylott,
Glasgow, Scotland.

Incentive Applied to Die Making

ELLSWORTH E. CLARK
Foreman of Die Design,
Westinghouse Electric & Manufacturing Company

PAYMENT for extra effort by some plan or method of incentive compensation has been in use for some time in the manufacture of products in which repetitive operations on parts, units, assemblies or completed products are involved. These incentive plans are variously known as premium rate, piece payment, time allowance, standard time, measured time, and possibly by other terms. The one referred to in this discussion is that known most generally as standard time-wage incentive and for this discussion will be referred to as standard time.

In general, it may be stated that where such systems of compensation are carefully planned and fitted to the work, with an equitable consideration of both employer and employees' interests, and then properly administered, they have been a success. Success in these applications means that the employer has controlled the labor content of his product through reliable pre-cost knowledge and that the employee or worker has been able by application, skill and effort to increase his earnings without increase in hours of time worked.

If these incentive plans of wage payment are workable and of advantage in straight-line manufacturing, why not extend their usefulness by application to other products of a more special or contractual nature? The die shop, whether large or small, whether engaged in building metal stamping dies for use in its own presses or as supplier of such dies to its customers, is vitally interested in costs. In most cases they have believed that dies and similar press tools can be made only with hourly paid labor because, except in the case of the additional tool, one die is never exactly like another, or the die is a special-purpose machine and is outside of all production rules of rate setting. So the die shop goes back to the old guess-cost system, trusting to the law of averages to come out on the right side of the book in the long run. However, any wage plan promising control of labor costs remains an interesting subject to the die shop, and while many arguments may be advanced as to why standard time cannot successfully be applied to die making, each argument offered becomes at once a reason for the need of such application.

It is not the purpose of this article to enter into a discussion of the methods or mechanics of the actual setting or establishing of time values. The competent time-study man is usually trained in the study of motion time setting and follows certain well defined rules and formulas which have been worked out to fit that particular line of work, and have as their basis the essential element of fairness to both employer and employee.

The effort here is to present as briefly and clearly as possible, a general plan for the application of standard time to die making, suitable for the die shop working from fifty to three hundred die makers. To do this, it is obvious that some details must be supplied to fit the conditions under consideration, and that the plan as outlined must necessarily be offered as that of the author rather than that of any particular die shop using and working under the standard time plan. It might be permissible, however, to say that it is based on considerable observation and experience in cost accounting, cost estimating, die making and die design, plus actual contact with the use of standard time in die work.

It has been said that one die is never exactly like another when compared with production manufacturing which, if any great activity is reached, is considered repetitive. There is a still further difference peculiar to dies. This is well known to the die builder but will be explained here for the benefit of the reader who may not be entirely familiar with the details of die making. We will, for the want of a better term, define it as the "unknown element." To clarify this, it is necessary to refer to Fig. 1, which shows a washer, and which suggests the progressive type of die. Whether the die makes one washer per press stroke or several, whether it is hand fed or automatic makes little difference. We know that if this die be given fair consideration in design and building it can be made to produce an acceptable sample on first set up and try out. Such minor adjustments as may be needed are practically without cost influence. In this first example, there is no unknown element.

Passing to Fig. 2, we find a bend. It is a clear

Fig. 1

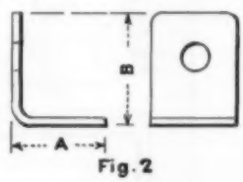


Fig. 2

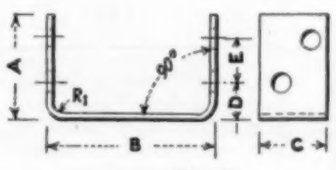


Fig. 3

Fig. 4

Fig. 1—Plain progressive die in which the "unknown element" is lacking. Fig. 2—Bending die where slip may occur and correction be necessary. Fig. 3—Phosphor bronze clip where both correction and development are a possibility. Fig. 4—The "unknown element" is present to an unusual degree in this example of drawn work

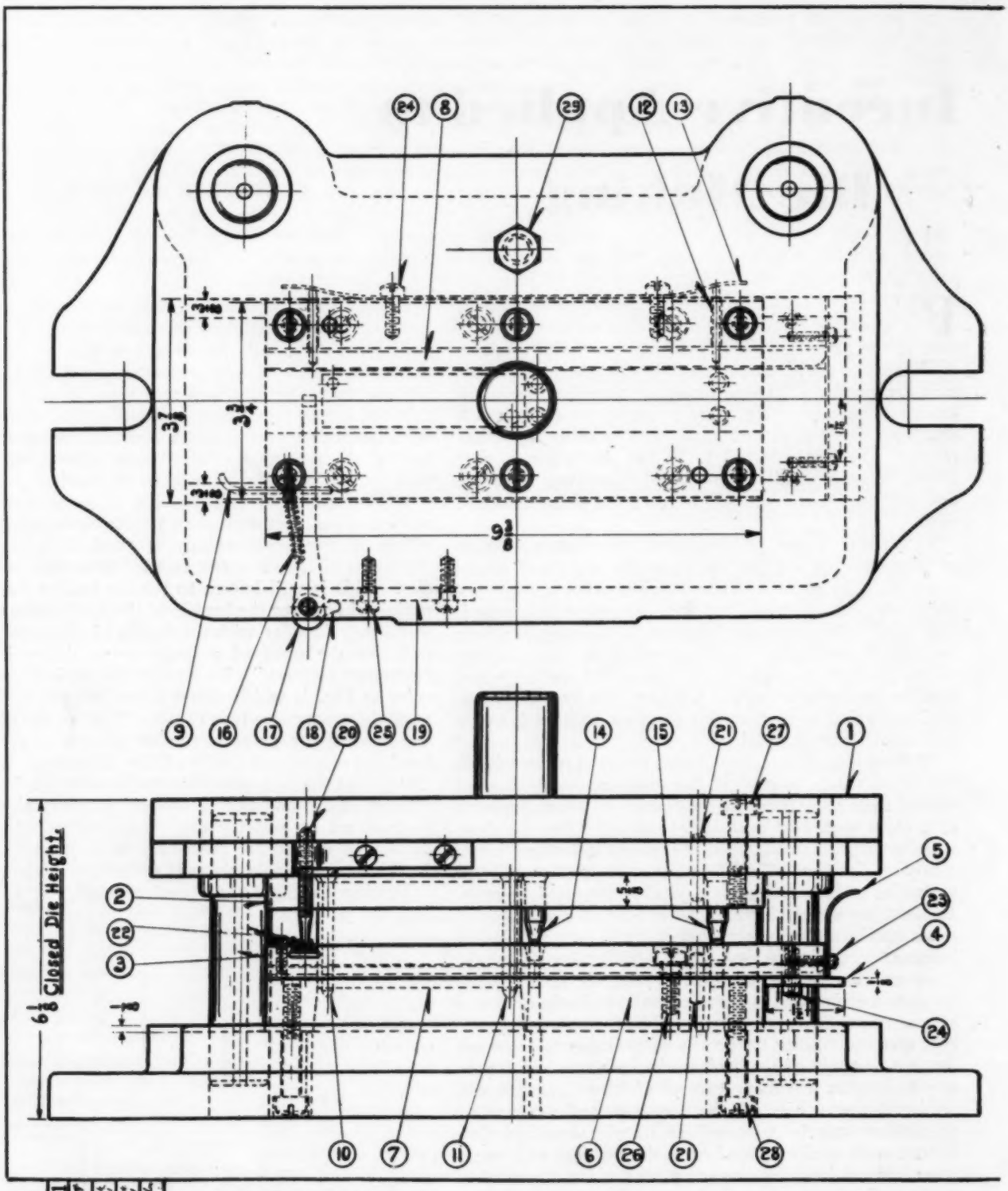
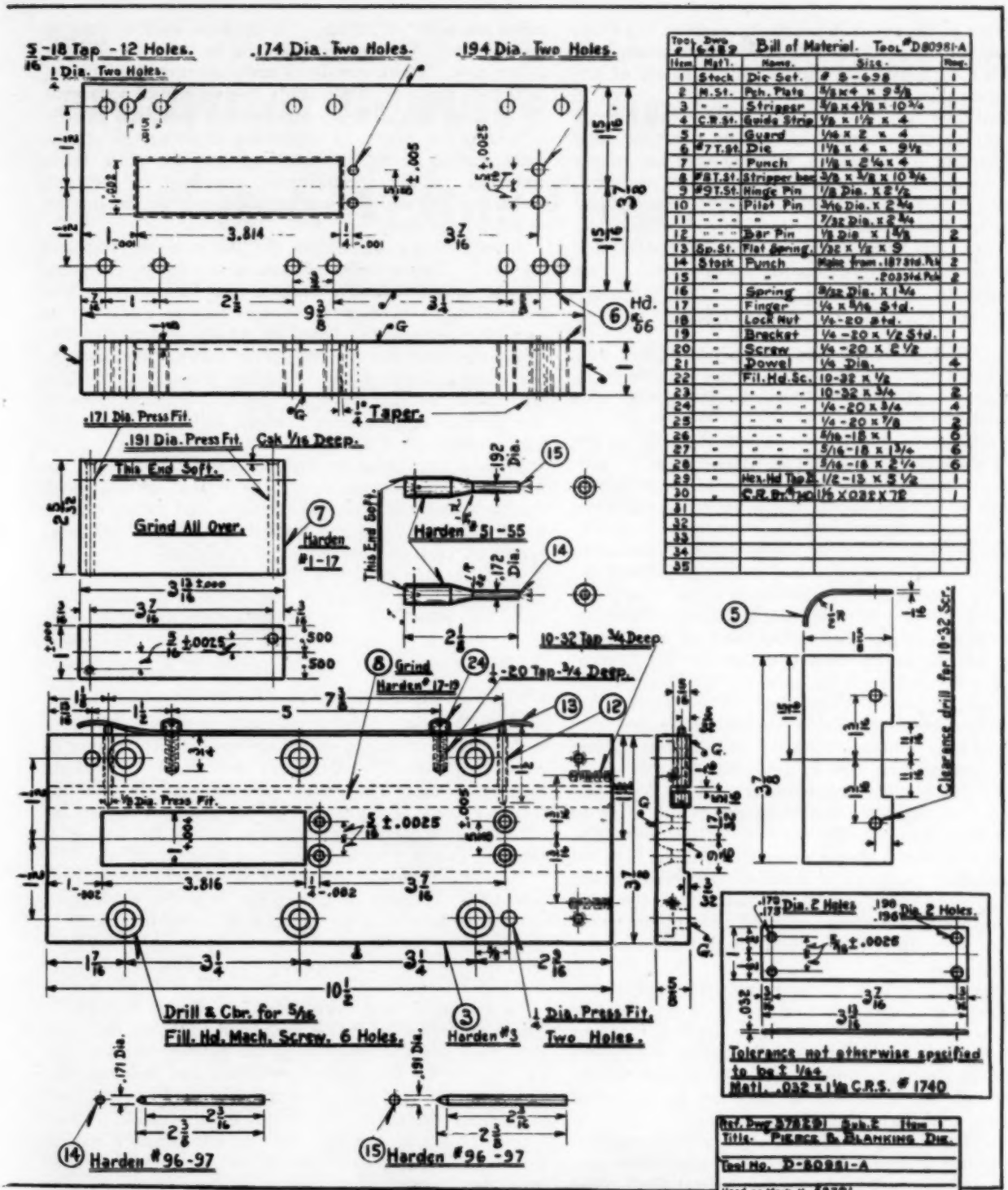


Fig. 5—Eliminating the "unknown element" makes setting of standard times on this complicated die only a simple problem

application of a forming die known as the "L" bender, familiar to all die makers and not considered a difficult type of die to produce. It is assumed that it has been well designed and well built. It passes to the trial set up for sample where it is found that it is pinching the metal; that is, it mars the surface. As a result, the *A* dimension is $\frac{1}{32}$ in. long; the B dimension $\frac{1}{32}$ in. short. All this may not occur, but in this case we assume that it has, and time will be required to correct it. In this illustration we have the first appearance of the "unknown element."

Taking Fig. 3 next, we have what might be called a bracket. In reality, it is a "U" bend with something added to give the designer and die maker trouble. The material is phosphor bronze, hard and resilient. Its bending radius is $\frac{1}{8}$ in. on 90 deg. without fracture. There is some variation in thickness, and the developed length must be found for gage setting as well as blanking die layout. Again we assume that the designer has done a


Bill of Material. Tool #D80981-A
Dwg. 6489
Item | Matl. | Name. | Size. | Req.
1 | Stock | Die Set. | # 8-698 | 1
2 | M.St. | Pch. Plate | 5/8 x 4 x 9 3/8 | 1
3 | - - | Stripper | 5/8 x 4 1/8 x 10 3/4 | 1
4 | C.R.St. | Guide Strip | 1/8 x 1 1/2 x 4 | 1
5 | - - - | Guard | 1/16 x 2 x 4 | 1
6 | #7 T.St. | Die | 1 1/8 x 4 x 9 1/2 | 1
7 | - - - | Punch | 1 1/8 x 2 1/4 x 4 | 1
8 | #8 T.St. | Stripper bar | 3/8 x 3/8 x 10 3/4 | 1
9 | #9 T.St. | Hinge Pin | 1/8 Dia. x 2 1/2 | 1
10 | - - - | Pilot Pin | 3/16 Dia. x 2 3/4 | 1
11 | - - - | - - | 7/32 Dia. x 2 3/4 | 1
12 | - - - | Bar Pin | 1/8 Dia. x 1 3/8 | 2
13 | Sp.St. | Flat Spring | 1/32 x 1/2 x 9 | 1
14 | Stock | Punch | Make from .187 Std. Pch | 2
15 | - | - | - - .203 Std. Pch | 2
16 | - | Spring | 5/32 Dia. x 1 3/4 | 1
17 | - | Finger | 1/4 x 5/16 Std. | 1
18 | - | Lock Nut | 1/2-20 Std. | 1
19 | - | Bracket | 1/4-20 x 1/2 Std. | 1
20 | - | Screw | 1/4-20 x 2 1/2 | 1
21 | - | Dowel | 1/4 Dia. | 4
22 | - | Fil. Hd. Sc. | 10-32 x 1/2 | 1
23 | - | - - - | 10-32 x 3/4 | 2
24 | - | - - - | 1/4-20 x 3/4 | 4
25 | - | - - - | 1/4-20 x 5/8 | 2
26 | - | - - - | 5/16-18 x 1 | 6
27 | - | - - - | 5/16-18 x 1 3/4 | 6
28 | - | - - - | 5/16-18 x 2 1/4 | 6
29 | - | Hex. Hd Tap B. | 1/2-13 x 5 1/2 | 1
30 | - | C.R. Bracket | 1/8 x 032 x 7/8 | 1
5/16-18 Tap - 12 Holes.
.174 Dia. Two Holes.
.194 Dia. Two Holes.
1/4 Dia. Two Holes.
.171 Dia. Press Fit.
.191 Dia. Press Fit. Csk 1/16 Deep.
This End Soft.
Grind All Over.
Harden #1-17
Harden #51-55
10-32 Tap 3/4 Deep.
1/4-20 Tap-3/4 Deep.
Grind Harden #17-19
1° Taper.
Hd. #66
Clearance drill for 10-32 Scr.
Drill & Cbr. for 5/16 Fill. Hd. Mach. Screw. 6 Holes.
Harden #3
1/4 Dia. Press Fit. Two Holes.
Harden #96-97
Harden #96-97
.170 .175 Dia. 2 Holes
.190 .196 Dia. 2 Holes
Tolerance not otherwise specified to be ± 1/64
Matl. .032 x 1 1/8 C.R.S. #1740
Ref. Dwg 37&291 Sub 2 Item 1
Title. Pierce & Blanking Die.
Tool No. D-80981-A
Used on Mach. No. #A791
Scale: 12" = 1 Ft.
Dwg. 16489-T
Dwg 37&291 Sub 2 Item 1
Order of Oprn. | Description Oprn. Dia or tool type | Tool No.
1 | Pierce & Blank | D-80981-A
2 | Bender | D-80981-B

good job, and the shop has likewise built a good die. The die passes to the trial set-up and a sample is made. It proves to be more wrong than right; two dimensions, no angles, and one radius only, check as correct. Corrections and adjustments follow, another trial set-up is certain, possibly still another. The die must be made to work and produce a product acceptable to inspection.

These examples would not be considered complete if we failed to include the single operation draw die required for the part in Fig. 4, which is a rectangular, pan-shaped vessel, and not difficult as draw dies go. The designer can calculate the required blank size but he seldom hits it right because there is nothing consistent in the flow of material. This requires blank development and attendant set-ups along with the other things necessary in the development of dies for drawn work. No die shop that has made draw dies will fail to admit that the "unknown element" exists to an unusual degree in this type of die.

In selecting these four examples we have taken four

types of dies of the common every-day variety. In shops both small and large much more difficult dies are built daily with a corresponding ratio of this element of unknown time value.

Standard time cannot be installed in a die shop without careful, intelligent preparation and planning. A time study group adequate in personnel, training and experience must be organized. Shop arrangement, routing and clerical systems may have to undergo changes. The fundamental principles of standard time are correct and will work. There can be no failure if properly applied and administered, and the presence of the unknown factor fully recognized.

An Estimate for the Designer

It is assumed that there has been a preliminary estimate made on the cost of the die under consideration, and on the basis of this cost the production of the die is to be undertaken.

This preliminary estimate goes to the designer, and is a part of the design information, as it covers the estimated cost of the die, type of die, and production activity along with specifications for the work to be made by the die.

It is obvious that, to supply the necessary information to the shop in the form of a tool drawing, the tool designer must be considerably more than a draftsman. He must know something of costs, shop practice and routing, he must be a practical tool maker, and he must know materials and the heat treatment of steels. These, combined with a design knowledge of correct structure, should result in an adequate tool drawing. The tool drawing in Fig. 5 has been selected for the possibilities it offers in standard time application, rather than for its subject interest. It should be kept in mind that the success of the application hinges largely on the break down for time values, the basis for this being the tool drawing in as complete form as possible.

Reference to Fig. 5 shows a total of 30 items required for the complete assembly of the die. Sixteen are stock items from store room, and of the latter, two, Items *14* and *15*, require a time value for grinding to the indicated diameters. Item *30* is the material needed to make test and inspection samples.

The time study group, working from this tool sketch, breaks down the labor content of the die and applies the time values. These time values once applied, may not be changed except by the issuance of a special work order controlled by the shop supervisor. The routing of the work through the shop may or may not be controlled by the time study organization.

To submit a system of paper work for shop standard time use would be impractical for specific application, and reference will be made only to the general shop order customarily issued to the shop for die construction. Five copies of this order should be prepared, designated by color or otherwise as, (1) stores, (2) building, (3) test and set-up, (4) development and correction, and (5) shipping. The five copies of the order go to their respective shop sections, each being attached to a blue print from the design sketch, which we have described as containing information to build the die. Time values for material cutting have been established for that labor, and the store room cuts the material, collects the standard die parts and accessories and forwards them to the machine or the building section.

The building section builds the die. It may also be called assembly or fitting. No machine work is done in this section. The building is done by a group of four to ten men. There may be as many groups in a building section as needed. Time study has set a time value for the building of the die in the building section. The die is built by the process of assembling or fitting the various parts coming from the machines and the store room according to the specifications contained in the tool sketch. This, and the workmanship, should be subject to rigid inspection.

After building inspection, the die goes to "test and try-out." This consists of setting the die in the press for the first time and making a trial for sample. The time value for this step of the work may be applied from an established schedule based on the size and type of die. The purpose of the test and set-up may appear obvious, but there is another and important reason. It enables the time-study man to apply the proper time value to any further development, changes and corrections that may appear.

With a time value applied for the final stage of the work, the "Development and Correction" section takes the die, makes corrections, sets gages, and makes what is usually the final test and try-out for sample, which, if approved, closes the order for this section.

On first consideration of the foregoing outline, adverse criticism will be offered to any division or split-up of labor into more than one section or group, but unusual as the suggestion may seem it will be shown that this is the basic requirement for the success of the application.

Less Complicated, More Accurate

To build a die from a complete, well-made drawing such as the tool design sketch we have shown, cannot be considered difficult, and borders very closely on straight manufacturing. The group personnel of the building section become highly skilled in that work. The building of the die, being segregated here, makes the setting of time values less complicated and more accurate.

With the approval of inspection, the building task is complete. There is no chance for defective work being allowed to pass with the thought of fixing it up later if discovered. For the same reason, a job cannot be fixed with the thought of influencing extra work benefit after test and try-out.

Development and corrections, at times, become so closely intermingled that it is difficult to isolate one from the other. In the example of the bending die required for Fig. 3, we have both corrections and development: the first, to produce an acceptable product; and the second, to determine the length of the blank. Other types of dies in test and try-out will possibly require correction without development, or the reverse. However, development should never be done in the building section, which only builds. If a blank size, templet or other developed dimension is required in the building section for the die in the process of building, it is supplied by the development and correction section. In actual practice it is possible to have this ready in advance of building.

Specialization has no part in the arguments for or against standard time here, and there is no thought to deprecate the value or retard the progress of the skilled die maker. The fitter in the building section cannot fail to become a better fitter. The die maker in the development and correction section becomes more skilled in development and trouble corrections.

Modified Gravity Curves for Quick Acting Cams

KARL G. HOLST

Uniform acceleration, as commonly employed in cam design, is not always suitable for quick action. Certain modifications of the cam curve will result in a smoother mechanism

THE GRAVITY, or uniformly accelerated motion, curve is generally supposed to be the one best suited for quick-acting cams. But it happens quite often that gravity cams give trouble even at speeds that seem quite moderate, as when a rather heavy body has to be moved a considerable distance in a short space of time. In what follows, the disadvantages of using the plain gravity curve as a cam curve will be pointed out, and also ways in which it may be modified to overcome these disadvantages.

The most likely cause of trouble, when the plain gravity curve is used at high speed, is that the retardation, and the force producing it, continue undiminished to the end of the movement. This is all right provided everything is rigid enough, but suppose for example that a long cam lever is used, made rather slender to keep down the weight, and that the cam is of the grooved type. Then the force, needed to produce the retardation, deflects the cam lever in the direction of the motion. When this deflection, like the retardation, remains undiminished to the end of the movement, it causes overtravel. When the force, causing the deflection, suddenly ceases to act, the elasticity of the lever causes recoil and more or less vibration. This can be avoided by so modifying the gravity curve that the retardation gradually decreases to zero at the end of the movement.

When the cam lever thus gradually resumes its true shape, no overtravel occurs, and no force is left to cause any recoil or any vibration. When the plain gravity curves are used, the retardation begins, and the acceleration begins and ends, just as abruptly as the retardation ends. Provided there is no backlash, these motions are not objectionable because there is no shock at the beginning of the acceleration or of the retardation. At the point where the acceleration suddenly ceases, vibration would be likely to set in if it were not prevented by the immediate starting of the retardation. Modifying the curves at all the four points in question does, however, make the motion smoother.

The acceleration diagram will then be of a type shown in Fig. 1. There the acceleration increases uniformly from zero (cube curve acceleration) during the first fifth, and decreases uniformly to zero in the last fifth of the acceleration period; the retardation increasing and decreasing in a similar manner. The uniform part of the acceleration will then be 25 per cent greater than before, but that is not necessarily a serious matter. This modification increases the radius of curvature at the beginning of the cam curve, making it possible to increase the diameter of the cam roll. This, in turn, makes it possible to reduce the time allotted for a short movement. The modified gravity curve corresponding to the acceleration diagram Fig. 1, is shown in Fig. 2, and can be constructed by means of ordinates like DE and EF. Using simultaneous values of the constants a and b in the table below, DE will equal a times DB, and EF will equal b times BA. The constants c are given for obtaining the vertical ordinates EG of the plain gravity curve, making them equal c times BA.

The lengths of the ordinates EF, Fig. 2, can also be obtained from a chart worked out with the aid of the table. Such a chart is shown in Fig. 3. There DB is any convenient length, and vertical lines are drawn accurately at distances from B equal to b times DB. Each one of these vertical lines is marked with the corresponding value of the constant a. If then OD is made equal to BA in Fig. 2, and the line OB is drawn, the lengths of the ordinates EF in Fig. 2 are equal to those

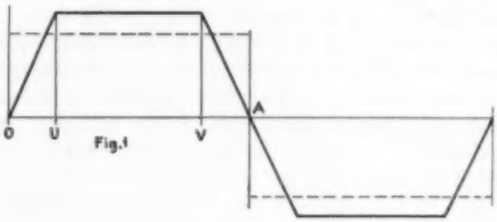


Fig. 1

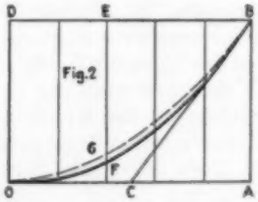


Fig. 2

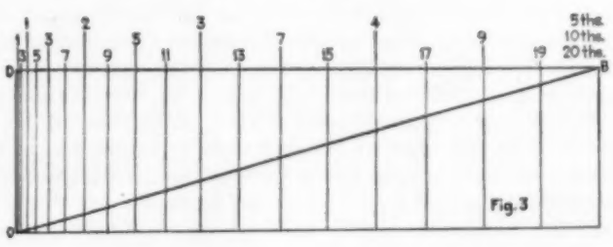


Fig. 3

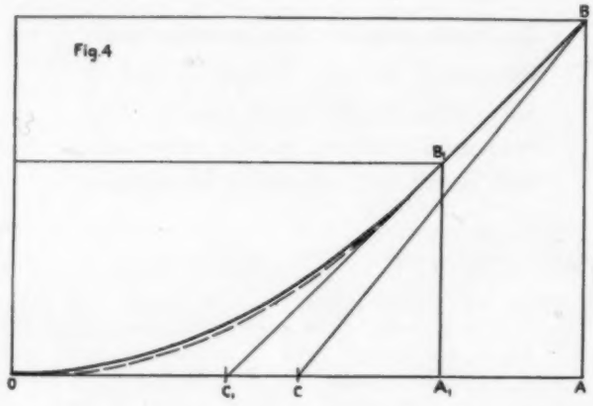
parts of the corresponding vertical lines in Fig. 3 which lie between OB and DB. A similar chart can be drawn for the plain gravity curve.

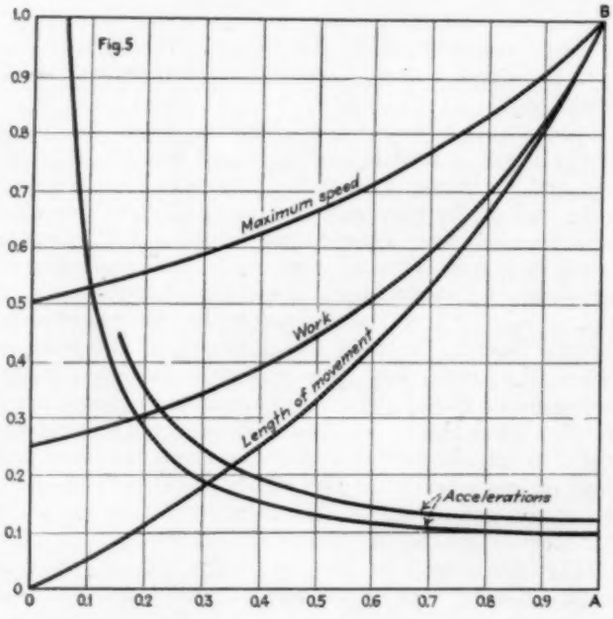
	Modified Gravity Curve	Gravity Curve
a	*b*	*c*
1/20	0.9997	0.9975
1/10	0.9979	0.9900
3/20	0.9930	0.9775
1/5	0.9833	0.9600
5/20	0.9677	0.9375
3/10	0.9458	0.9100
7/20	0.9177	0.8775
2/5	0.8833	0.8400
9/20	0.8427	0.7975
5/10	0.7958	0.7500
11/20	0.7427	0.6975
3/5	0.6833	0.6400
13/20	0.6177	0.5775
7/10	0.5458	0.5100
15/20	0.4667	0.4375
4/5	0.3833	0.3600
17/20	0.2969	0.2775
9/10	0.1979	0.1900
19/20	0.0997	0.0975

The fact that with the plain gravity curve the uniform acceleration continues to the middle of the movement, and that the uniform retardation then begins immediately, carries with it several disadvantages even if it does make the maximums of the acceleration and of the retardation the smallest possible. It makes the maximum speed greater and also the curve itself steeper than necessary. It is desirable to keep down the maximum speed, for this determines the amount of work required to overcome the inertia in accomplishing the movement, and according to the formula for kinetic energy, the work required to produce a certain speed is in proportion to the square of the speed. The maximum speed may be reduced by increasing the acceleration at the beginning of the movement. It will be found that even a small increase in the acceleration can produce a considerable reduction of the maximum speed, and of course, a still greater reduction in the corresponding work.

Fig. 4 shows a way to reduce the maximum speed by shortening the time of the acceleration, still keeping it uniform, but making it somewhat greater. BA represents one-half the length, and OA one-half the time of the movement. To make the acceleration last from O to A_1 instead of from O to A, make $C_1A_1 = \frac{1}{2}OA_1$. Join points C_1 and B, and draw B_1A_1. A gravity curve drawn in the usual manner from O to B_1 will be the tangent to BC_1 at B_1. This means that the acceleration will cease, and the speed will become uniform at B_1. The effect, which the shortening of the period of acceleration has on the maximum speed, the corresponding amount of work, the acceleration itself, and the length of the movement up to the end of the acceleration, is shown by the curves in the chart, Fig. 5. Each horizontal ordinate represents a length of the period of acceleration, with OA, corresponding to OA in Fig. 4, as a unit for comparison. For the same purpose, the ordinates on the line AB are taken as units for the vertical ordinates of the other curves.

There is great danger of vibration at the end of the period of acceleration if the parts are not rigid enough, but in that case, a cube curve modification of the gravity curve, like that shown in Fig. 2, can be used. This curve will also be tangent to BC_1 at B_1 in Fig. 4, but the acceleration will be increased as shown by the upper acceleration curve in Fig. 5. The period of acceleration can be shortened as much as the size of the cam roll will allow if the pressure on the cam surface does not become so great as to cause undue wear; or if the time, during which the acceleration decreases. does not become shorter than the time it takes the deflected parts to resume their original shapes. Shortening the period of acceleration reduces the torque on the cam shaft and also makes it easier to overcome other resisting forces besides inertia and friction if such are present. Combining these modifications with each other or with the plain gravity curve makes it possible to adapt the cam curves to different requirements.





The modified gravity curve shown in Fig. 2, can be derived in the following manner from the acceleration diagram Fig. 1.

Referring to Fig. 1, let:

u = Distance from O to any point between O and U
u_1 = Distance from O to U
v = Distance from U to any point between U and V
v_1 = Distance from U to V
w = Distance from V to any point between V and A
w_1 = Distance from V to A
i = Rate of increase of the acceleration

Then

$$-\frac{u_1}{w_1}i = \text{Rate of decrease of the acceleration.}$$

The acceleration at any particular time will be:

In the first section $= iu$
In the second section $= iu_1$
In the third section $= -\frac{u_1}{w_1}iw + iu_1$

The speed at any particular time will be found, by integration, to be:

In the first section $= \frac{1}{2}iu^2$
In the second section $= iu_1v + \frac{1}{2}iu_1^2$
In the third section $= -\frac{1}{2}\frac{u_1}{w_1}iw^2 + iu_1w + iu_1v_1 + \frac{1}{2}iu_1^2$

The length of movement from the starting point at any particular time will be found, by a second integration, to be:

In the first section $= \frac{1}{6}iu^3$
In the second section $= \frac{1}{2}iu_1(v^2 + u_1v + \frac{1}{3}u_1^2)$
In the third section $= iu_1\left[\frac{1}{6w_1}w^3 + \frac{1}{2}w^2 + (v_1 + \frac{1}{2}u_1)w + \frac{1}{2}(v_1^2 + u_1v_1 + \frac{1}{3}u_1^2)\right]$

(These expressions become much simpler when numerical values are substituted for i, u_1, v_1, and w_1.)

The subtangent AC in Fig. 2, of the motion curve is equal to quotient of the length of the whole movement and the speed at the end of the movement. Dividing this quotient by $(u_1 + v_1 + w_1)$, we find what fraction AC is of OA. This will be equal to 0.5 when $u_1 = w_1$.

If $u_1 = 4$, $v_1 = 12$, and $w_1 = 4$;

Then the acceleration will be:

In the first section $= ui$
In the second section $= 4i$
In the third section $= -iw + 4i$

The speed will be:

In the first section $= \frac{1}{2}iu^2$
In the second section $= 4iv + 8i$
In the third section $= -\frac{1}{2}iw^2 + 4iw + 56i$

The length of movement from the starting point will be:

In the first section $= \frac{1}{6}iu^3$
In the second section $= 2i(v^2 + 4v + 5\frac{1}{3})$
In the third section $= 4i(-\frac{1}{24}w^3 + \frac{1}{2}w^2 + 14w + 98\frac{2}{3})$

And, with $w = 4$
$s =$ The whole length of movement
$s = 640i$

Therefore: $i = \frac{1}{640}\ s.$

If we give the values 1, 2, 3, 4 successively to u; 1, 2, 3, ... 12 successively to v; 1, 2, 3, 4, to w; and the value $\frac{1}{640}\ s$ to i, and substitute above, the corresponding values of the acceleration, the speed, and the length of movement from the starting point will be expressed as constants multiplied by the length of the whole movement. The constants b given in the table for EG in Fig. 2 have been arrived at by subtracting those for the ordinates from OA, obtained as explained above, from 1, the ordinates EG being handier to use.

Using Discarded Production Machinery in the Toolroom—*Discussion*

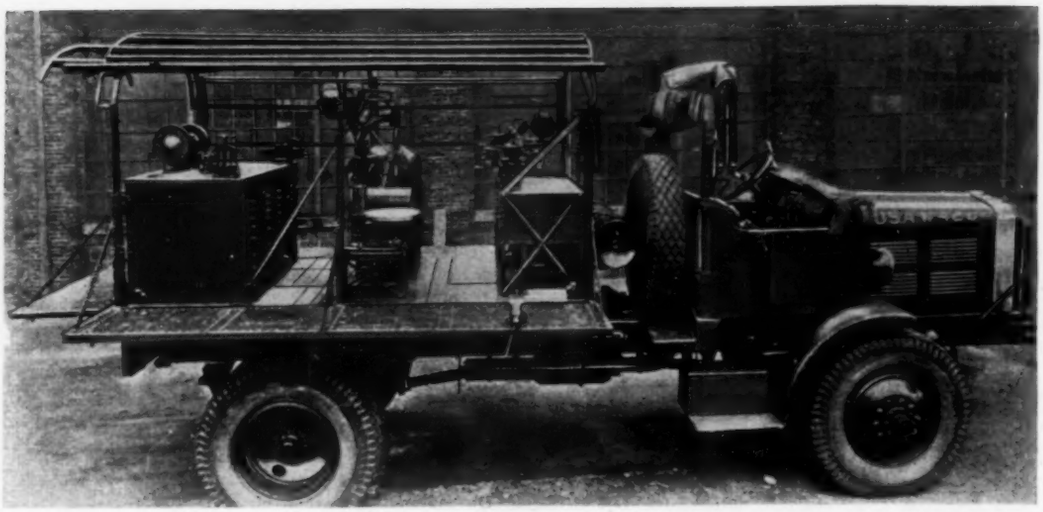
ARTHUR SILVESTER
Sales Manager, The Iten Fibre Company

Several of your readers state that they are at a loss to understand why discarded production machines are not made use of in the toolroom (*AM*—Vol. 74, page 280, and Vol. 57, page 371). There are several good reasons why this is not done:

1. In the majority of instances when a machine tool is discarded on production, it is not fit for further use and would need complete overhauling and repair to make it profitable to use in any department. It certainly would not be true economy to incur the expense to set it up in the toolroom, when it could only be used on certain work where accuracy is unessential.
2. In by far the majority of toolrooms, the volume of suitable work for such a machine is not sufficiently large, necessitating long periods when the machine could not be used.
3. There is lots of work in the larger toolrooms of course that does not warrant or justify a highly skilled toolmaker or the use of a costly machine tool but most concerns pass this class of work on to the production department on a special work number, where it is run through on piecework and charged to the tool account.
4. There are different standards of accuracy and requirements in the toolroom just as there are in the various lines of engineering. For instance, tools for use on tubes, shipbuilding, boiler construction, or bridges do not generally call for the accuracy that is necessary on telescopes, instruments, engines, radios, and airplanes.

Francis W. Shaw says that a turret lathe should prove a valuable asset in even a small toolroom. In those I know of, it could be utilized profitably only two-thirds of the time because of lack of suitable work. Therefore it would be cheaper, when a batch of tool work or parts suitable for a turret machine come along, to have it machined in the production department.

With regard to the instance mentioned of a prospective customer, who was under the impression that a turner on an ordinary lathe would machine a stud faster than on a turret lathe, the writer is curious as to the period when this occurred. Thirty years ago, I was making such pieces as pin studs, plain and threaded, up to 2½ in. diameter and 16 to 24 in. long, in large quantities for a gas and steam engine concern on what was then commonly called a capstan turret lathe. This type of machine was in common use and was made in large quantities by James Archdale & Company and Ward Machine tool Company both of Birmingham, England.



A machine shop on wheels—the new light machine shop truck developed by the Ordnance Department, carrying a complete machine shop with lathe, milling attachment, grinder, and drill press

Mechanization Increases Industry's War-Time Task

RICHARD SAUNDERS
Washington Office, American Machinist

Coming close on the heels of the series of articles by Captain Soderholm discussing industrial manufacture of ordnance, this article describes new developments in mechanized units and outlines some additional difficulties of future war-time industrial production. It gives additional evidence of the present need for sound and constructive "educational orders."

EVER since the visit of the King of Siam to Washington, when the traditional cavalry escort formerly accorded distinguished guests was abandoned for a guard mounted on motorcycles, it has been obvious that one of the last strongholds of glamorous military pageantry must at last yield to mechanization. A troop of cavalry is impressive enough as an escort, but its use is limited, for in order to keep pace with the reception cars, the cavalrymen must put their mounts to a gallop. It is dangerous for mounted troops to indulge in such speed in a city because of the danger of slipping and the injury to horses' hoofs resulting from a sustained gallop over hard-surfaced roads.

In planning for the defense of the nation, it is of course small consequence whether a troop of cavalry with guidons flying makes a more impressive picture on Pennsylvania Avenue than a squadron of motorcycles. The part the horse plays in the next war will be smaller and will steadily diminish. At present, the horse is still without a peer in a mountainous terrain or in heavily wooded country; elsewhere, combat units are made more strategically mobile by means of mechanical power.

Newly developed six-ton tank with Franklin engine and radio equipment, capable of making nine miles per hour. The engine is rear-mounted

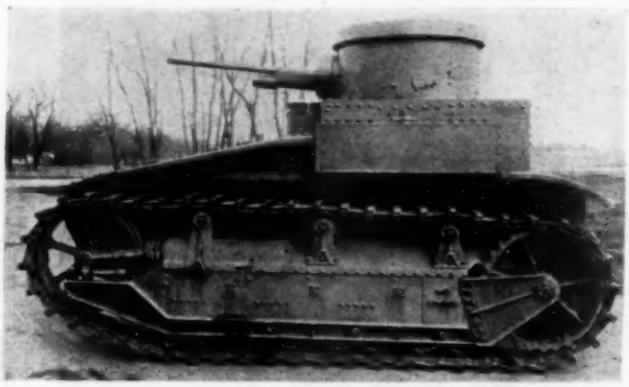
Under most conditions, transportation equipment similar to that available commercially may be relied upon to bring supplies up to the war zone, but after the war zone is reached no condition can be regarded as constant. The enemy forces cannot be expected to stick to open country or to sections criss-crossed by good roads. Combat and supply vehicles in the war zone, therefore, must be capable of cross-country travel. Since commercially there is but slight demand for a cross-country vehicle and no demand whatsoever for a fast vehicle of this type, Army ordnance officers have been obliged to do their own designing, adapting to their use where possible commercial developments.

Several years ago the Army attained considerable success in maneuvers with a motorized unit composed of trucks and highway carriers. As a result, the War Department is now conducting maneuvers with a mech-

anized force capable of traveling cross-country. Final tests are being made at Fort Eustis, Va. Entirely equipped with tanks, tractors, and cross-country cars, this unit will be able to execute the same surprise attacks and flanking movements in modern warfare that made the cavalry famous in Civil War days.

If lacking in the dashing appearance of the Civil War Cavalry, this new unit has compensating advantages in its superior speed and striking power. The cargo carriers, newest tractors, and light tanks are capable of a speed of 20 miles an hour. In the way of heavy armament, 75-mm. guns and other field pieces will be carried, mounted directly on high-speed tractors. Anti-aircraft machine guns, chemical mortars and ground machine guns also will be carried. Supply vehicles with tractor drive will carry the war materials and sustaining infantry.

Light tanks and armored cars will comprise the advance scouting force. Two types of light tanks will be used, weighing between 7 and 8 tons. The first type, used during the latter part of the World War, has been given a new power plant, consisting of a Franklin air-cooled motor, and can develop a speed of 9 miles an hour. Formerly, this tank could travel no faster than 5. The second new tank can make 20 miles an hour. Cross-country cargo and infantry carriers will be mounted on the same chassis and will be capable of higher speed.



Another newly developed light tank incorporating some welding

Next in the formation of the combat unit will come the field artillery, followed by the 0.50-caliber anti-aircraft machine gun vehicles. The last element of the unit will be maintenance vehicles. As the mainstay of the maintenance group there will be a complete machine shop with lathe, milling attachments, grinder, and drill press mounted on a 4-wheel, wheel-drive truck. This truck will also carry a gas-electric generator for running the equipment. A high-speed truck without the machine-tool equipment will be provided for small repair jobs. For general power supply purposes, there will be a generator truck with a 15-kw. set. There will also be a wrecking truck of the 6-wheel, 4-wheel-drive type equipped with an overhead runway and a chain hoist.

In determining the best means of employing each type of vehicle the Ordnance Department places prime dependence on the track-laying vehicle for cross-country travel, but it is steadily improving the multiple-axled truck for off-road service. To give trucks of the 6-wheel type greater mobility for off-road service, a removable track has been devised which can be placed over each set of driving wheels. This track operates on the friction drive principle. It is still believed that there are great possibilities in developing a type of wheeled truck that will push further into the field of the track layer, although, of course, such a vehicle will never supplant the track layer for the more difficult type of cross-country travel. In this connection developments are expected in the automotive industry toward the perfection of a vehicle with individually sprung wheels.

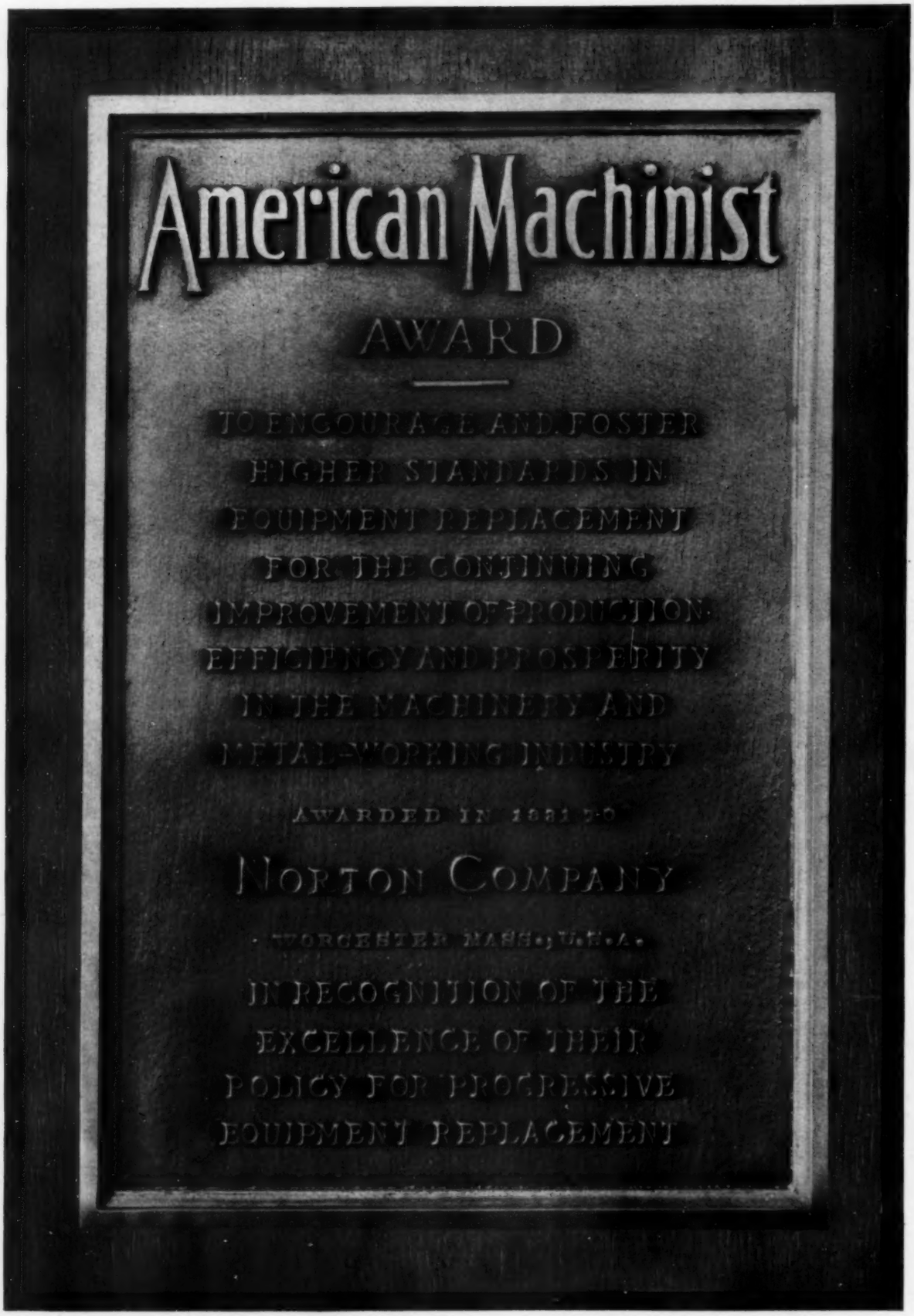
For its own part, the Ordnance Department already has designed a new type of truck that has been particularly adapted for cross-country travel by doing away with the axles on the drive wheels and the long drive shaft. This vehicle has its power plant located in the extreme rear so that there is no long drive shaft to buckle. Power is supplied to the wheels by a chain driven from sprockets. When better traction is desired, a belt is slipped over the drive wheels and is operated by the wheels mounted on the drive shafts.

The general trend is toward high-speed track layers and tanks with a low silhouette as far as combat use is concerned. An important element in the design of these vehicles is whether or not they can be turned out promptly and on a large scale by private industry. Costly delays occurred in the last war because of the difficulty in getting certain spare parts. With the aid of the war planning section, however, it is expected that the aid of the machinery and manufacturing industries will be much more effective in the event of another war. After a new design has been developed and is adopted, it is turned over to the war planning section which makes arrangements with private plants for quantity procurement.

Although constantly alert for new and better types of equipment, the Ordnance Department cannot afford to take the risk of placing dependence on equipment that cannot be produced on a large scale commercially.

In reference to automotive Diesel engines, the developments are being watched with great interest, but so far it is believed that the weight is too great for the amount of power delivered. It is realized, however, that there are tremendous advantages in fuel-saving possibilities, for combat vehicles must be prepared to operate far from established bases. To a somewhat lesser extent it is believed there are possibilities in steam propulsion, but here again the trouble is that there is practically no commercial production. In general, the policy is that it is better to forego what may be an improved type of machine if private industry cannot go into production with a fair degree of promptness. The all-important thing is that the machines of war must be ready on short notice. Industry must be ready to build them.

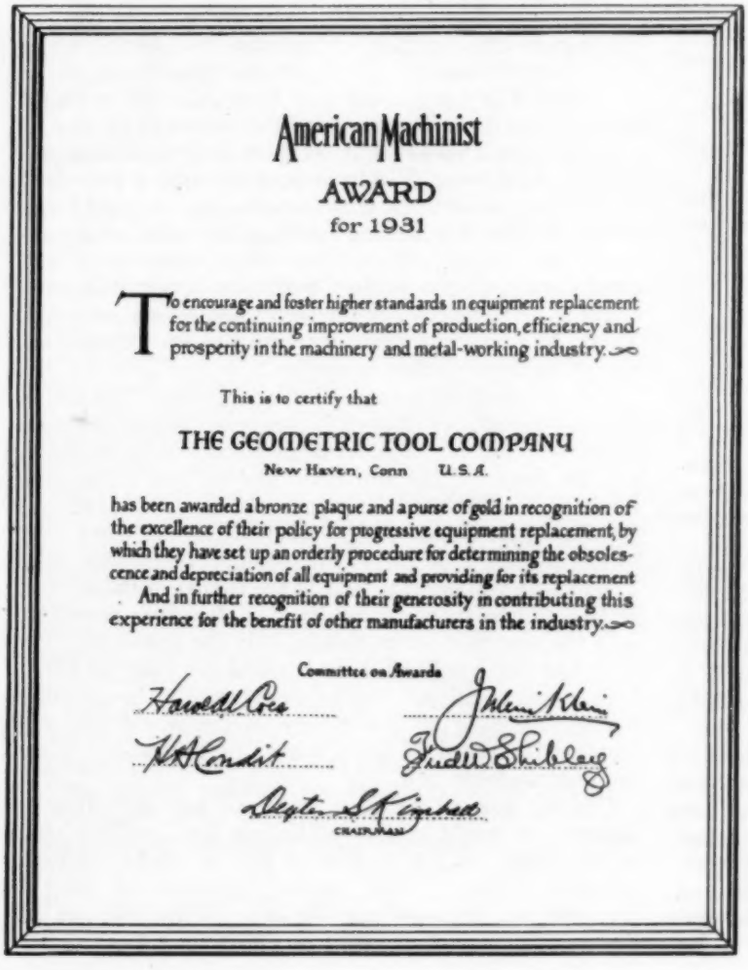
An artillery motor reel of the track-laying type



The winner's plaque (approximately one half size). Another bronze plaque, identical except for the winner's name, was awarded The Geometric Tool Company

The Winners Receive Their Awards

STRICTLY in accordance with plan and schedule the *American Machinist* Awards for 1931 were presented to the representatives of the winning companies—Norton Company, Class I; The Geometric Tool Company, Class II—at a dinner meeting of the American Management Association, Hotel Statler, Cleveland, O., November 12, 1931. Philip E. Bliss, president, The Warner & Swasey Company, presided; Dexter S. Kimball, dean of engineering, Cornell University, made the principal address of the evening; Kenneth H. Condit, editor and publishing director, *American Machinist* and *Product Engineering*, presented the two bronze plaques, the two purses of gold, and the two Certificates of Award; W. La Coste Neilson, vice-president, accepted for Norton Company, and G. S. Tracy, assistant sales manager, for The Geometric Tool Company.



American Machinist

AWARD

for 1931

To encourage and foster higher standards in equipment replacement for the continuing improvement of production, efficiency and prosperity in the machinery and metal-working industry.

This is to certify that

THE GEOMETRIC TOOL COMPANY

New Haven, Conn U.S.A.

has been awarded a bronze plaque and a purse of gold in recognition of the excellence of their policy for progressive equipment replacement, by which they have set up an orderly procedure for determining the obsolescence and depreciation of all equipment and providing for its replacement.

And in further recognition of their generosity in contributing this experience for the benefit of other manufacturers in the industry.

Committee on Awards

Harold L. Rice — John Younger Klein

K. H. Condit — Fred W. Shibley

Dexter S. Kimball — Chairman

Certificate of award (approximately one quarter size). Another hand-lettered certificate, identical except for the winner's name, was presented to Norton Company.

CHAIRMAN BLISS: Tonight you have what I believe will prove a very interesting program before you. About the subject I would like to say nothing; about the speaker I would like to tell you a few things. I hardly know where to begin—there is so much one can say about him.

He spent his young manhood out on the Pacific Coast. He served a machinist apprenticeship there. He attended and graduated from an engineering school. If I remember the story rightly, he went to work for the Union Iron Works. There he spent some time working as an engineer. Later he came east and taught engineering subjects in one of the universities. Then he went back to business again. For a period of several years he served as an engineer in an advisory way to several important corporations.

Then he went back to college and took charge of a very important part of it. He has written very many worth-while things, spoken to audiences of many sorts. He has degrees from universities—you could call him "Doctor" several times over. He is very modest. He does not like to hear this part. He asked me not to say these things about him. If you don't know them, I want you to.

Few men, either in or out, have done any better thinking about the problems that confront business men and have expressed their ideas of solution any more clearly than the man who will shortly address you. To me, more interesting than any of those things is this thought and impression I have about him—that is that he is a fine, kindly gentleman. He is a man that everyone who knows admires and respects, and loves. He is going to speak to you on this subject: "The Interplay of Factory Equipment Modernization and Industrial Sales Stability." Your speaker is Dexter S. Kimball, Dean of the Engineering School of Cornell University. Dean Kimball, we invite you to speak.

DEAN KIMBALL: I hope you won't take too seriously all the nice things my friend said, nor too seriously the title that has been put down before me. That is all right, but a professor always reserves the right to talk about what he pleases.

I hope, also, that nothing I will say tonight can be construed as prophecy. As I listen to the discussions here and elsewhere, I hear a

good many people prophesying about the state of business, what may or may not come. As I get older, I am less inclined to prophesy. . . . As your Toastmaster said, I have had a long contact with industry. As a matter of fact, in my lifetime a greater change has come in this and similar countries in industry, in economics and in social contacts, than in all the years man has been on the face of the earth. Automatic machinery came just about the time I was born. From then to now, more change has been brought about than in all the years man has been on the earth.

Instead of sticking to the text—I will touch upon it somewhat—I would like to give you some of my ideas of some of the things we may and may not see in the near future.

I did work for some years on the Pacific Coast, at the old Union Iron Works. In the latter part of the century it would have been a typical plant. I am glad he reminded me of that because it was a good plant—about 3,000 men, building anything that you had money to pay for in the way of iron products. We built everything from little coffee mills and sampling mills for prospectors to full-rigged battleships.

The Simple Life

Life was simple. We were living in what we call a seller's market, had no salesmen and no sales policy. Two men were the most I ever saw in the sales department. Business came to them. They had to bid, of course, on the battleships, but for the most part, that great mining business they had, engines running up to $50,000 and $75,000 a set, came to them. People came and asked them to build things.

Decisions were not rendered by policies; decisions were rendered by personal judgment. The chief engineer was the court of last resort. He would decide all the last questions, and so it went. And they made money. It was easy to make money in those simple days.

About the beginning of this century those conditions began to change. We began to get into what we call quantity production. The automatic machine and the semi-automatic came to the front, and perhaps more due to the automobile than anything else, we began to get into what we call quantity production and a new viewpoint. This isn't like the old days. The machinery of the plant of which I speak was simple, standard; obsolescence was not an important factor. It didn't wear out. Replacement policies were simple.

Shortly after the opening of the century, however, this mass production thing began to grow. And we took on a different viewpoint with regard to the way we would make the world's goods.

We have pushed this viewpoint to an amazing degree—I don't need to tell you men that. We have filled the world full of all sorts of interesting things, and perhaps have made ourselves more comfortable than any group of people that ever lived on the face of the earth, so much so that we are a marvel to everybody outside of this country, and a marvel to ourselves.

Some time before this depression, as long as the field could be expanded, as long as the field should be expanded, there was no trouble. In the early days of the automobile business, we couldn't make them fast enough. The prices fell, the field expanded. The prices fell again, the field expanded again. And it is still going on. Nevertheless, long before this depression, there began to be good signs of a tightening. There came in just things as you have been discussing today—sales policies. Installment selling.

What is the limit?

A lot of thought has been given to the limits. As yet we don't know the limit to the automobile. We are getting some limits. We thought that the dollar watch was quite an accomplishment. This is a dollar watch (indicating). My own is being repaired and I have this. I saw some of these for sale in Buffalo last night for 69 cents. How cheap will the watch be made? Twenty-five cents? I think so. Ten cents? Possibly. It may be that watches will be made so cheap that you can give them away.

Obviously, if you could give watches away, you would have some limit. You wouldn't want to carry around more than four or five, even though you give all the children one. In other words, there is a limit of consumption. We have that now in grain. We cannot eat all that we can raise.

W. La Coste Neilson, who accepted the *American Machinist* Award, Class I, for Norton Company

Is there any danger when things start we will again expand our manufacturing industries, as we did during the war? What form of stabilization must be reached in every industry as you approach the limit where you can give things away?

Here is a thing that I think is even more important and this refers to the size of undertakings. This has only occupied the minds of economists a short time. We have gone through a period of mergers, consolidations, combinations, etc. A good many people believe that we are reaching the point where industry no longer will combine into greater units, and maybe some of the present units are larger than they ought to be. The reasons for such thinking are scattered. There isn't any one thing you can put your finger on, except through certain analogies.

Let me give you some of these analogies. So far as size and complexity of tools is concerned, we do not need to worry. We can build as large a machine as we wish, and the limits of the automatic tool are yet to be seen. Look at the automatic cigarette machine. Marvelous! Or the A. O. Smith plant. There is no apparent limit to the ingenuity, so far as the mechanical machine goes. The minute you begin to look at the results of these tools, certain things appear immediately. In other words, it isn't the size that limits things, it is the economy.

In one thing only have we reached the limit, and that is in communication. Not by any stretch of imagination nor by spending all the money in the world can you increase the speed of telegraph or of the radio. They are instantaneous now.

Coming now to industry, have we any such line in industry as would lead us to believe that industry may be over-built, too big, or perhaps that we should go back and look it over? The nearest mathematical thing I can give you is something like this: First you put an investment into a plant, suppose $40.00 in a tool. After

the $40.00 are invested, this watch costs you $1.00. Your equipment costs $40.00, your work a dollar. If you make only one part, the whole thing costs you $41.00.

If you make two, it will be $40.00 plus $2.00, divided by 2, $21.00—you cut it in two. Make ten, divide by ten. It is a curve that comes down like this (indicating) and flattens off very rapidly. The gains are all made in the early part of the cycle. If you make an infinitely large number, you will bring it down to the $1.00 cost. The limits are the tool plus the cost, and down here (indicating) the tool disappears and you get the plain cost of $1.00. They are not long slanting curves. They fall very rapidly. The second one you make almost cuts it in two; by the time you get to 200 you have skimmed off the cream. The next thousand or so, it is less; the next 100,000, even less; up to 500,000 or 600,000, you cannot notice the difference. We call that, in economics, the old law of diminishing returns. It gets harder and harder to get the last bit of gain. People are looking at the size of industry in this country with that curve in mind. Maybe some of these industries are too large. . . .

G. S. TRACY, who accepted the *American Machinist* Award, Class II, for The Geometric Tool Company

Going back to the beginning of economics, Adam Smith taught, and many economists are still teaching, that labor values and productive costs are one and the same thing. They were, under handicraft. In handicraft your labor cost is your productive cost. You all know that isn't so now. The labor cost might have little to do with productive cost. The labor cost in this A. C. Smith plant, worth ten million, is operated by 200 men; the labor cost isn't a big item.

New Values

We have come into a new period where new values have come to us, and many of these economic ideas are going to be radically changed. It is hard for an old fellow like myself to come to these deferred paying plans, installments, but the world is going to have a lot of new things along the line of economics.

May I revert again, for a moment, to the times before 1890. I said all decisions were rendered by persons; personal judgment was the thing. The chief engineer rendered his judgment; he didn't have any chief salesman. If anybody was in a tight corner, the man in authority gave judgment on it at the time and place it occurred. We don't do that any more. Out of this complex life of ours has come a different viewpoint. I should be perhaps considered egotistic if I should tell you all these things are nothing more than the adaptation of the engineering point of view. But that is what they are.

This market research you are carrying on is not one bit different from the engineering research to build a steam engine. It is identically the same thought. You get all the facts of your case, draw your conclusions, and use that as a means of protecting your business. It all, of course, takes you back to the scientific method.

Replacement of Equipment

I don't know of anything quite so important as the matter of equipment replacement. Equipment used to be a simple thing. You bought a boring mill; it lasted forever—some of the tools did last amazingly long times. Today that is not a good policy.

The whole question of equipment, therefore, is one not to be tampered with. When you are talking of equipment, you are talking about invested capital. It cannot be fooled with.

It has only been within the last twenty years that we have had a real understanding of depreciation, obsolescence and replacement policies. It is a new thing. In a way we have hardly outgrown the days of 1890. It was the importance of that particular phase of the work that induced, or rather started Kenneth H. Condit of *American Machinist* to think along these lines. It was the basic reason for the *American Machinist* Awards competition. I believe it is one of the most important phases, one of the most important features of policy.

So, as you know, this competition was started. Some of us were invited to serve as judges. It appealed to me particularly because it was a thing I had long had in mind. It was along the lines of work at the University where we have been teaching some of these things, and we appreciate the difficulties and the importance of it. I was very glad to serve on the committeee. It was not an easy thing to do. The great group of leading papers, sent to the judges to read, were all so good that it was a difficult thing, indeed, to decide who was who. I am not so sure now but what it was 50-50 with some of them. So far as the judges could decide (and they were unanimous) we selected these winners. As you know, the competition was divided into two parts—those with a million or more of output, those of less than a million. In the first group, the judges were unanimous that the prize should go to the Norton Company. I will ask Mr. Condit to make the award. The other prize is awarded to the Geometric Tool Company. To the prize winners go, to use the words of Mr. Condit, a purse of gold. This has gold in it, really (indicating), and I am asking J. La Coste Neilsen of Norton Company to come first and receive this gold and this commemorative plaque.

MR. CONDIT: On behalf of the Committeee of Awards, I have pleasure to present to you as representative of the Norton Company, the purse of gold, the certificate of award, and the plaque.

MR. NEILSON: Thank you very much.

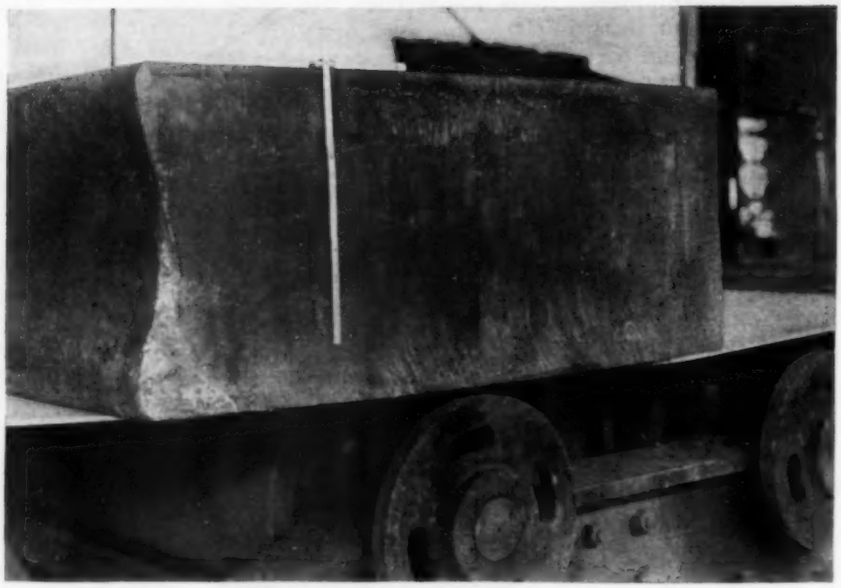
MR. KIMBALL: The other prize for plants with less than a million output goes to The Geometric Tool Company. I will ask Mr. Tracy to come forth and receive his.

MR. CONDIT: Mr. Tracy, I have the same kind words to say to you.

MR. TRACY: Thank you.

MR. KIMBALL: I look on this award and the discussion I have given you as merely a starting point for many similar things. Each and every one of these policies that I have mentioned, and others that will grow, are worthy of the most careful consideration. I believe that only by the establishing of policies can we manage or handle these various enterprises. No one individual is sufficient, and no better work could be done by this group than to assist in establishing good, clear-cut, sound economic policies. A lot can be done. I am not so sure that we know all we should about replacement.

L. M. Curtiss, superintendent of the 140 and 206-in. Rolling Mills, Lukens Steel Company, discusses before the 32nd Annual Convention of the International Acetylene Association some methods and effects of



A remarkably clean gas-cut 22-in. slab. Lukens cuts up to 28-in. gage with excellent results

Machine Gas Cutting

DURING the development of machine gas cutting, the first thought was to "make the cut," especially on extreme thicknesses, and secondly to give the edges a good, smooth, pleasing appearance. Little thought was given to the actual cost of the operation, as the advantage to be derived was so great that it overshadowed the expense of cutting. Cutters were generally paid a straight hourly rate, and were given general instructions by the foreman on how the job should be done. An incentive wage payment plan was considered illogical because a large plate could easily be spoiled by hurried work and because the labor involved in cutting was not the initial consideration. The cost of oxygen and acetylene consumed in cutting heavy thicknesses is several times that of the labor. There was the danger that an operator, in accomplishing his task in the least possible time, would use excessive oxygen, thus more than counteracting any benefit derived from fast work. Lukens Steel Company tackled this problem with many misgivings and was many times advised that it could not be solved. After much study, however, a payment plan was devised whereby each man was paid for the exact amount of work accomplished, and in addition, a bonus was paid on the amount of oxygen saved below a set standard; a penalty was also applied for poor workmanship. This plan was successful from the beginning, and each succeeding month showed an improvement in labor efficiency. The oxygen consumption, instead of climbing, took a downward course. The quality of cutting was in no way impaired and the amount of rejected material due to carelessness was materially reduced.

Effect of Cutting

There has been considerable discussion, especially among the users of steel plate, as to the effect of gas cutting on the material cut. When observed microscopically, the cut edge is found to be materially altered, as compared with the original metal. Apparently this is a physical change, as the pearlitic steel has been transformed into an unstable condition, taking one of three forms; sorbitic, troostitic or martensitic, according to the amount of carbon present in the steel and the speed with which the metal is cooled. This physical change is due to the metal adjacent to the cut being heated considerably above its critical range and cooling quickly through this range. The drop in temperature is caused by heat conductivity of the cold surrounding metal, by radiation losses, and by the fact that the heat is applied only momentarily at any one point, the machine being in constant motion while cutting. Another interesting change is the tremendous grain growth which occurs on the gas cut edge, the grain size gradually tapering back to the normal size in the original metal. Ordinarily, grain growth is caused by holding a piece of steel at an elevated temperature for a prolonged period of time; both temperature and time being functions of its progress. The development of the grains in this case is due principally to the intensity of the heat, as the time element is very short.

The change in the altered area has previously been considered as a physical, not a chemical, alteration, but it has lately been discovered that the carbon content is increased on the burned edges. When the specimen is annealed, however, this carbon difference is equalized.

The next step was to try and find the cause of the carbon increase, the three possibilities being: (1) Absorption of carbon from acetylene; (2) Pearlite and Sorbite might give different carbon results under the same method of analysis; (3) An actual local change due to physical alteration.

Carbon analyses were taken from several samples, some cut with acetylene and some with hydrogen, the idea being to compare the effect of the two fuels. The results indicate that any increase in carbon on the outside

cut edge cannot be attributed to the carbon in the gas. Cut sections were annealed in order to re-establish the pearlitic condition, and were then analyzed for carbon. These checked identically with the original samples. This, of course, eliminated the possibility of obtaining a difference in carbon from sorbite and pearlite under the same method of analysis.

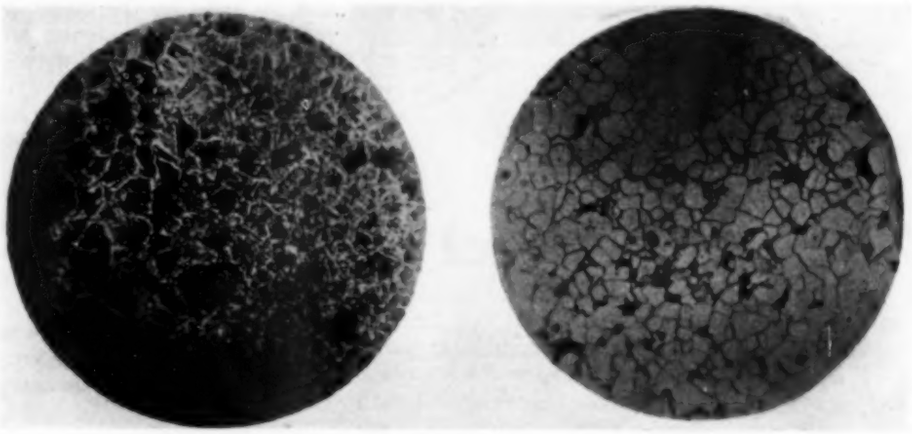
The one remaining explanation for the increase in carbon of the outside gas cut edge is that the pearlitic patches in the original steel have been absorbed while passing through the transformation range, forming what is known as austenite, or a solid solution. When the cooling action starts, the ferrite is thrown out of the solid solution first, thereby making the remaining solution higher in carbon. In view of the fact that the hottest part of the metal is next to the kerf, the carbon migrates toward this hotter zone, where it is finally concentrated. Sorbite is formed because the metal is cooled so quickly that the pearlite does not have a chance to re-establish itself. This is checked by the fact that whenever a gas-cut piece is normalized or annealed the area of increased carbon and altered physical structure disappears completely and the steel returns to its original state.

These physical and chemical changes in the steel leave a thin hardened zone on the outside edge, the penetration of which is usually superficial. With ordinary steels of 0.30 carbon and under, no particular difficulty is experienced in bending or fabricating, as the sorbitic hardening is not intense. With high-carbon and alloy steels, the precautions of annealing or machining should be used to remove the hardened edge. There are some exceptions, however, in the low-carbon steels; where a bend occurs with the gas-cut edge on the outside surface, or in a machine part where stresses are concentrated at one point and the member is subjected to the fatigue of intermittent tensile stresses. In cases of this kind, all traces of gas cutting should be removed by annealing, planing or grinding. It is extremely necessary to remove any nicks or notches to avoid incipient cracks.

If the simple precaution is taken of preheating the steel before gas cutting, the cooling effect will be retarded and this will prevent, to some extent, the formation of sorbite and reduce the hardness. High-carbon and alloy steels, such as chrome-vanadium, which are particularly susceptible to temperature changes, should always be preheated, and should be annealed immediately after cutting to re-establish the pearlitic condition.

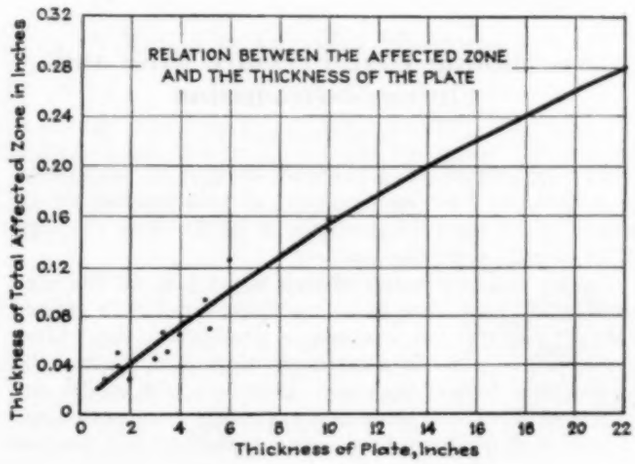
Hot cutting is not only beneficial to the steel, but is also economical in the use of oxygen. Any steel is more easily oxidized at elevated temperatures than at atmospheric temperature. Special care must be exercised, however, on particularly thick sections, where the interior is considerably hotter than the exterior. The oxygen may start its penetration without much difficulty, but upon entering the interior of the section may fail to go through and will cause a flare-up in the cutting. This stoppage is caused by the hot center, which oxidizes so readily that a cavity is formed on the inside of the piece and the flame, once being diverted, is not easily adjusted. The operator at this point usually makes the wrong move by increasing the pressure, which intensifies the trouble and increases the size of the cavity to such an extent that the slab may be ruined. There are some differences of opinion as to the proper temperature of the steel for the most efficient use of oxygen to obtain the correct penetration, and to leave the steel in the best shape metallurgically. For all practical purposes 500 to 600 deg. F. should give the best combined result.

Quite a problem is presented in making clean, economical cuts in steel slabs between 20 and 30 in. thick. A generous supply of fuel is needed to support the preheating flame. High oxygen pressure is required to penetrate the entire thickness, so that the molten oxide may be blown out of the kerf. If excess pressure is used, a large amount of oxygen passes straight through the cut without having any oxidizing action upon the metal and is consequently wasted. In order to compensate for this loss, the pressure may be reduced and the volume increased by the use of more than one regulator, and in some cases by using special equipment, such as a three-hose torch with large openings and extra large hose.



Photomicrographs of the sorbitic structure (left) of a gas-cut edge, and the pearlitic structure obtained on the same edge through annealing

Graphic relationship of depth of penetration of the altered zone and the thickness of the material cut

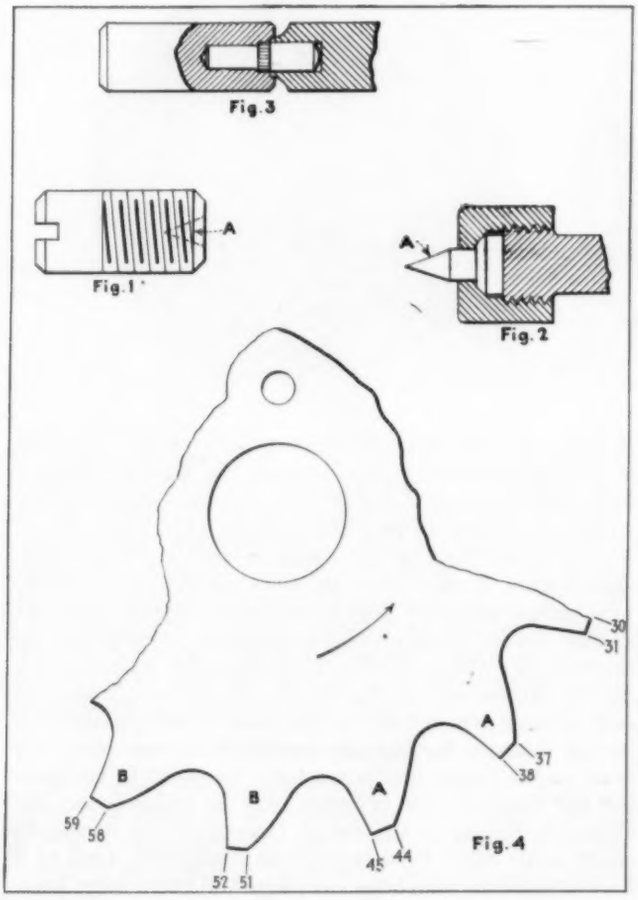


Ideas from PRACTICAL MEN

Swaging and Staking in Automatic Screw Machines

HAROLD P. BERRY

Successful swaging and staking operations can be performed in automatic screw machines before the pieces are severed from the bar. When performing such operations, either the spindle can be stopped or the tools revolved at the same speed as that of the spindle by suitable mechanism or by frictional contact with the work. The work can be done in any automatic screw machine where provision is made for dropping back the tools so that several successive blows can be made upon the work.



Point swaging, such as is illustrated in Fig. 1, is an advantage on the bearings of pivots for balance wheels of clocks, and for bearings in instruments in which friction must be reduced to the minimum. It will readily be seen that on very small work, extreme accuracy would be required in the set-up for machining such a definite point as is indicated at *A*. The swaging is done by an automatic center punch, such as the B & S, slightly altered to suit the holding fixture. The point of the tool should be replaced by one of the shape indicated at *A*, Fig. 2. To insure longer life and to permit the inner end of the tool to be softer than usual, the point may be chromium plated.

Automatic assembling of small pins into parts of softer material, as indicated in Fig. 3, can be performed by staking, the pins being placed in the staking tool either manually, or automatically from a magazine. The tool inserts the pins in holes already drilled and reamed and stakes them by successive blows. Here, too, an automatic center punch having a suitable tool is used. After the staking operation, the piece is severed from the bar by the cut-off tool. In using the automatic center punch, it will be found that some little experimenting will be required to determine the proper spring pressure to be applied to the internal mechanism of the tool.

In Fig. 4 is shown a part of the lead cam of a single-spindle machine of the B & S type. The lobes for the operation of the blow-delivering mechanism of the automatic center punch are shown at *A* and *B*, and could be arranged for the use of a roughing and a finishing tool by indexing the turret, or it may be found by experiment that the existing arrangement of lobes can be changed to include any number to suit the requirements of the job.

Operations of the types described can also be performed on multiple-spindle machines, and are applicable to the Davenport automatic. In this machine, the type of cam to be used will be similar to the one shown in Fig. 4, except where two tools are used, one for roughing and the other for finishing. In machines of this type, it is possible to stop the revolution of the spindles while the pointing or staking operations are being performed. In machines in which the spindles cannot be stopped, it will be necessary to use tools that are designed to revolve in unison with the spindles.

Assembling High-Pressure Hose and Fittings—*Discussion*

H. B. SCHELL

The experience of J. Conrad Watson in assembling high-pressure hose and fittings, as told by him in an article under the title given above (*AM*—Vol. 75, page 179), recalls a similar problem.

In this case a quantity of rods about ¼ in. in diameter and 14 in. long were to be tightly covered with rubber tubing; and the job was one of production, too. After trying many methods without any degree of success, the proposition looked hopeless. However, the model department solved the problem by means of compressed air.

One end of the tubing was attached to the air line

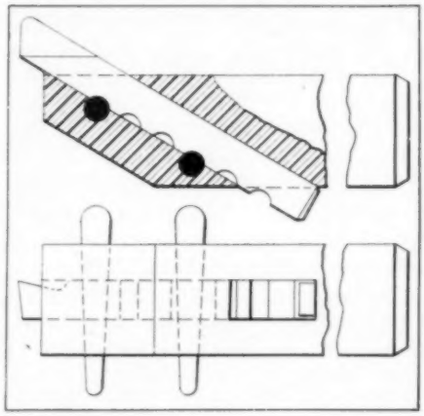
and the end of a rod was pressed to the other end by hand. When the air was turned on, in passing through the tube and around the end of the rod, it expanded the tube sufficiently to permit the rod to be easily pushed into place. As soon as the air was shut off, the tube contracted and gripped the rod so tightly that it could not be withdrawn.

If the openings of the hose fittings mentioned by Mr. Watson had been closed by plugs, they could have been assembled to the hose in the same way as were the rods.

A Method of Holding Toolbits

J. T. TOWLSON
London, England

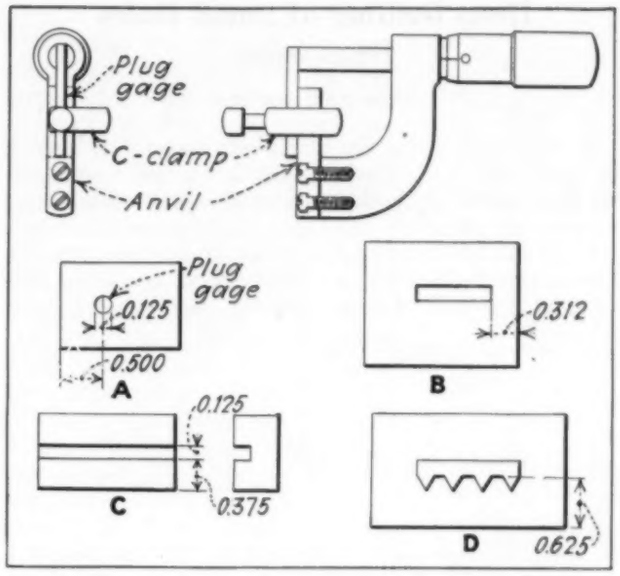
Ordinary toolbars used for work that is too large in diameter for the carriage to pass under are generally fitted with comparatively light and flimsy setscrews for holding the toolbits. Such screws, often breaking or becoming burred at the ends, are the bane of the machine-shop foreman. Furthermore, when such screws do break under the stress put upon them by the wrench, it is by no means unusual for the operator to injure his hand by striking it against the rotating work. As an improvement, I recommend the method of holding the toolbits by taper pins, as shown in the illustration. It will be seen that the toolbit is not only held by the tightness of the pins, but is fixed in position by their setting in grooves ground adequately along it. Just a light tap on the large ends of the pins suffices to hold the toolbit against the pressure of the cut. An equally light tap on the small ends will suffice to release it, when it can be drawn out of the bar, toward the operator.



A New Use for Old Micrometers

GEORGE E. BANHAM

An old micrometer that has seen better days can be converted into a very useful tool by cutting off part of the frame, shortening the screw and attaching a special anvil, as shown in the illustration. For this purpose all that is necessary is a piece of ¼-in. square tool steel, two 8–32 filister head screws, a small C-clamp, and of course, that old micrometer you were thinking of discarding. We have six of these converted micrometers in our toolroom and the toolmakers use them in preference to height gages.



If, for instance, the location of a ⅛-in. hole in a block is to be determined, as at *A*, clamp a 0.125-in. plug gage to the anvil by a small C-clamp, insert the gage into the hole and bring the screw against the edge of the block. The reading will show the distance from one side of the hole to the edge of the block. Adding one-half the diameter of the hole to the reading will give the center distance.

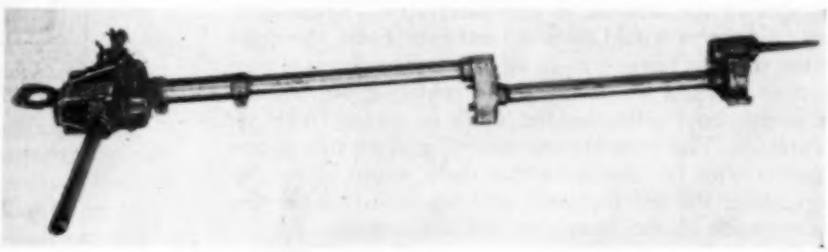
The distance from the end of a slot to the edge of a block, as at *B*, can be measured by clamping to the anvil a plug gage that is smaller than the width of the slot. Work such as at *C* and *D* can be measured by clamping gages of the correct sizes to the anvil. With this improvised tool around the toolroom, it is surprising how many jobs will be found for it.

Offset Reamer Drive

FRANK C. HUDSON

Reaming around a corner is frequently done with universal joints. The device shown goes it one better by going around two corners and coming back into line again. It is a special tool driving device for getting over an obstruction between the operator, the power, and the hole to be reamed. Steel tubes, spur gears, and suitable bearings held in housings stiff enough to prevent undue springing are the main requisites.

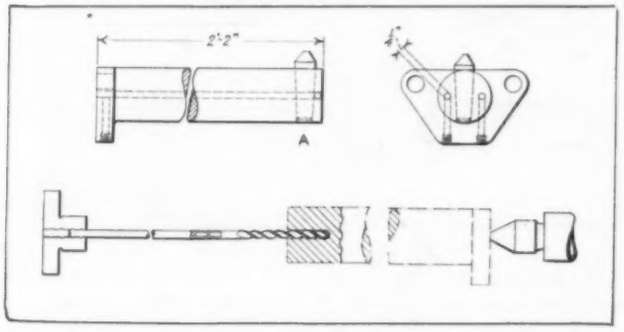
Such a device can be modified to suit many special cases with the driving shafts at angles to meet the requirements of the special job. Where work must be done in almost inaccessible places such devices save enough time to warrant them even for infrequent use. This is from the Norfolk & Western shop at Roanoke.



Deep Drilling of Small Holes
Discussion

HENRY W. BOEHLY

In an article under the title given above (*AM*—Vol. 75, page 248), J. T. Towlson describes a method of drilling deep holes. I think his method is a good one, and it reminded me of a job I had to do some years ago. The job was drilling two ¼-in. holes, 26 in. deep, through a brass arm for holding the electrode in a welding machine, as shown at *A* in the sketch. As the arm became



hot during the operation of the machine, it was necessary to provide means of circulating water through it hence the holes.

Had we possessed a tool of the type described by Mr. Towlson, the job would have been done much more easily and quickly. However, I used the tailstock screw for the feed, the drill being held in a chuck in the lathe spindle. Since the holes were drilled half-way through from each end, the drill had to be long enough to reach slightly beyond the center. A straight shank drill was turned down on the shank, slightly taper, and a piece of drill rod was drilled so that the turned-down end of the drill would be a driving fit. After the drill and the rod had been driven together, solder was applied at the joint. As an additional precaution a small hole was drilled across the drill rod and through the shank of the drill, into which hole a pin was driven. To prevent undue friction, the drill rod was slightly smaller in diameter than that of the drill. The drilling was carefully done and the job was satisfactory, the holes meeting closely in the center.

Piloting Fixtures on Faceplates

JAMES MC INTOSH

The value of general-utility lathes can often be increased by the addition of fixtures attached to the faceplates, and a method of quickly and accurately locating such tools would be an advantage. With this condition in mind, I decided to standardize a series of shallow recesses in the centers of our faceplates. Recesses of three diameters would cover all our equipment, the depth of the recesses being ¼ in. in all cases. The recesses were used as a means for locating and centering our fixtures by using short pilots on the faces in contact with the faceplates. The certainty and ease of making the set-ups, together with the assurance that there would be no slippage under the heaviest cuts, well repaid us for the necessary work on the faceplates and the fixtures.

Suitable driving pins to fit the slots in the faceplates were put in the fixtures, and the usual bolts were used to attach them to the faceplates. By the use of special tool-holding devices, both front and back of the work, we obtained a high degree of accuracy at a considerable saving in time. Suitable strips fitted to the lathe beds as stops for the longitudinal travel of the carriages by hand, together with adjustable stops for the cross-feeds, were effective.

Cutting Spiral Grooves

D. Q. DUNSTONE
Hetton-le-Hole, England

We recently received an order for a quantity ot sockets for wire rope. The rope joint was made by removing the hemp core, inserting a conical plug in its place and putting a taper bushing over the rope and the plug, so that as the tension on the rope increases the grip becomes greater.

Six grooves were cut in each plug, so the strands of the rope would be half buried in them at the major diameter, the depths of the grooves to diminish as the minor diameter was approached. The grooves were not to be of constant pitch, but approximately constant inclination to the center line of the plug; that is, the lead of the groove between any two points was to be proportionate to its length measured along it. A comparison of the two types of grooves is given in Fig. 1, in which the dotted lines represent a groove of constant pitch.

The grooves to be cut were to turn through 180 deg. of the conical parts of the plugs. Although accuracy was not required, the job presented quite a problem in a plant that had no universal milling machine. The work was done in a plain milling machine, the centers being set over to suit the taper of the plugs, keeping in mind the allowance for the decreasing depth of the grooves. The driver was a collar having six radial holes and held to the shanks of the plugs by a setscrew. The driving pin could be screwed into any one of the six holes, thus providing for indexing the plugs.

A former having an angular slot milled to fit the driving pin was made by wrapping a piece of sheet steel

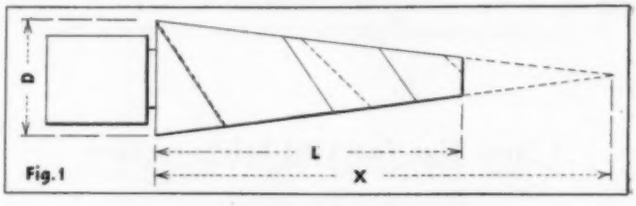


Fig. 1

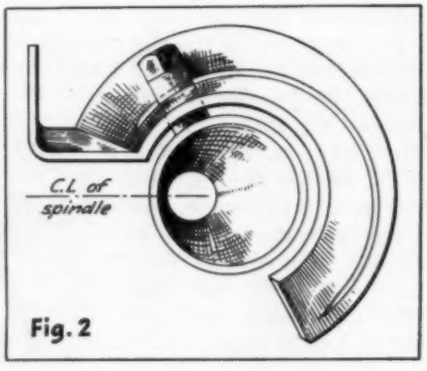


Fig. 2

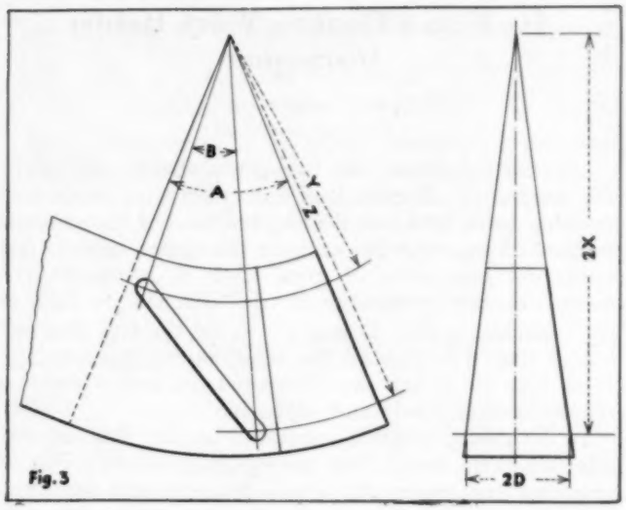


Fig. 3

about a mandrel that was twice the diameter and twice the length, but of the same taper, as the plugs to be grooved. In use, the former was attached to a stationary part of the machine, the driving pin protruding through the angular slot. An end view of the set-up is shown in Fig. 2. Thus it will be seen that as the table moves, the driving pin will travel through the angular slot in the former and rotate the work.

Development of the former is shown by the diagram in Fig. 3. Since the taper of both the plugs and the mandrel is 3 in. per ft., or 1 to 4, the dimension $X = 4D$.

$$\text{Angle } A = \frac{2D}{4X} \times 360$$

But since

$$X = 4D, \text{ angle } A = \frac{2D}{16D} \times 360 = 45 \text{ deg.}$$

Because the work is required to turn through 180 deg. only;

$$\text{Angle } B = \frac{A}{2} = 22.5 \text{ deg.}$$

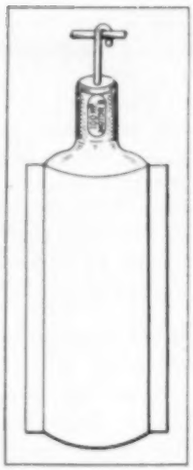
Radius Z = the length of the completed cone, which has a major diameter of $2D$, and is equal to $2X$ or $8D$. Radius $Y = Z - L$. (For value of L see Fig. 1.) The outline of the former, before being wrapped around the mandrel, is described by arcs of greater and smaller radii than Z and Y, respectively, and subtended by the angle A. The material to the left of angle A is for attaching the former to the machine.

Babbitting Mandrels

W. S. GALLMAN

When not in use, our babbitting mandrels were kept on a bench and were often knocked off and damaged. The man who does our babbitting was continually kicking about the condition of the mandrels, especially the crookedness of the wings. Upon examination of the mandrels, the foreman put me to work to make a new set.

After turning the bodies to size they were slotted for the wings, which were made a driving fit. The strips from which the wings were made were thick enough to allow for finish on the sides, the finishing being done by straddle milling with the mandrels on centers, thus making them straight with the bodies. One end of each mandrel was drilled and tapped for a hook bolt by which it could be hung up, as shown in the illustration. The size of each mandrel and the particular bearing it was to be used on was stamped upon it in a position where it was visible when the mandrel was hung up.

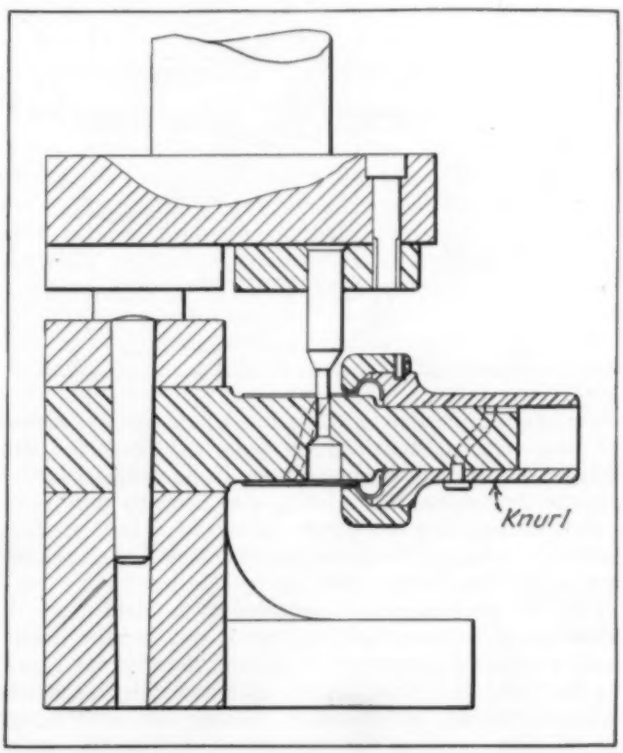


Having true wings on a mandrel eliminates the necessity for filing off from the bearings the metal that will persist in running around crooked wings. Each time a file is used, a certain amount of iron in the bearing joints is filed away, the natural rocking of the file resulting in the joints being open at the ends. This condition, besides causing considerable trouble in chucking the bearing for boring, permits the oil to seep out when the bearings are in use.

Press Tools for Nibbling Helical Slots

JOHN J. MCHENRY

At times we are required to produce parts in limited quantities, with a possibility of larger orders in the future. Such requirements prohibit the making expensive tools, and for just such an instance, the tools illustrated were designed. The work consisted of a comparatively small quantity of shells, each to have cut in it a helical slot $\frac{1}{8}$ in. wide and having a lead of $\frac{3}{8}$ in. in 180 deg. As will be noted, the die is of the horn type



and is used in connection with a $\frac{1}{8}$-in. round punch. A hole through the horn provides a means of exit for the slugs.

The outer end of the horn is reduced in diameter and has a helical groove milled half-way around it, the groove being of the same lead as that of the slot to be cut in the work. A straight groove in the top of the horn leads to the start of the helix. The work is held in a holder that fits the outer end of the horn and is locked by three equidistantly spaced bayonet locks. In the holder is a pin fitting both the helical and the straight grooves. Thus it will be seen that when the pin is in the helical groove, rotating the holder will also rotate the work in the path of the helical groove in the horn.

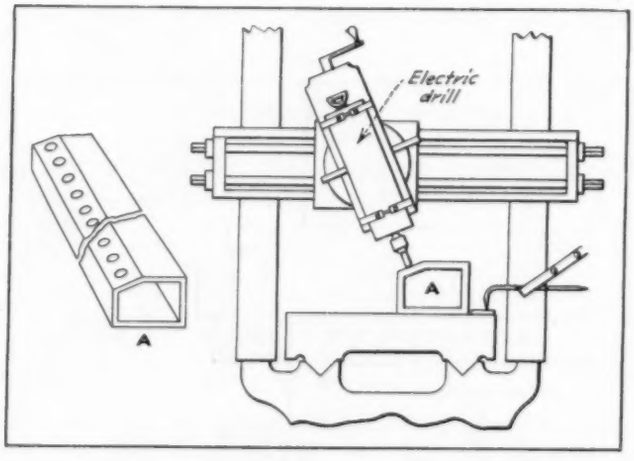
With the press running continuously, the operator slowly rotates the work by the knurled end of the holder, the punch cutting the slot by nibbling. In a short-stroke press running at 225 strokes per min., the operator handles the work easily. Tools of this type can be used for cutting slots of difficult shapes, especially where they cover too much of the work diameter to permit punching at a single stroke.

Drilling on the Planer

CHARLES KUGLER

When planned work is to have a series of small holes drilled in it, it is sometimes convenient to do the drilling without taking it from the planer. Especially is this so when the holes are to be drilled at an angle. The clapper should be removed and an electric drill should be clamped on the clapper box, as shown in the illustration. It is important that the center line of the drill should be parallel with the down-feed slide.

In some cases, the graduated collar on the cross-feed



screw can be used in spacing the holes, that is where the holes are to be drilled crosswise of the table. In the case illustrated, the holes were to be drilled lengthwise of the table. The spacing was done by means of a scale clamped to the planer table and a bent scriber attached to one of the housings, the table being moved by rotating the driving pulley by hand.

Had the work shown been drilled in the drill press, it would have been necessary to lay it out for the holes, block it up to the required angle, and move it for spacing the holes. If a radial drill were available, the holes could, of course, be spaced by moving the head along the rail, thus avoiding the necessity of shifting the work.

Jig With a Floating Work Holder
Discussion

C. A. COPPACK
Leicester, England

In an article under the title given above (*AM*—Vol. 75, page 285), Donald Raeburn criticizes a method of reaming work held in a floating holder, but his alternate method of reaming the work in the turret lathe is certainly not productive of great truth or accuracy. His method contains a number of "ifs" that are the bane of the toolmaker's life. I have yet to see the true floating-holder that will give all the requirements of accuracy. How long do chuck jaws remain true, and when is a reamer correctly held and supported?

If the steady brackets suggested by Mr. Raeburn are attached to the turret, they are subject to slight errors of indexing, and one might as well dispense with them and hold the reamers short in the turret with the absolute minimum of projection. If the turret holes are out of line with the spindle and the reamers are aligned by the brackets, they must be bent (which is possible with reamers having small shanks), or else held in floating holders of the rigid type. In either case, we might as well return to the reamer held short in the turret. I doubt if there is, at the moment, a solution of this problem that will give absolute accuracy, as there are many factors that are likely to disturb the ideal set-up.

Hardening Steel

WALTER W. YAEGER

In an effort to secure better results in hardening intricate, irregularly shaped punches and dies, some experimenting was tried with unusually good results. Perhaps the results of our experiments are nothing new, but they may help someone in the future.

The steel used was Ketos, and while we got satisfactory results in regard to the minimum of cracking, we were trying to prevent warping. It was with this in mind that the experiments were conducted. Instead of quenching the steel in oil, we used Houghton's tempering salts at a temperature of from 350 to 600 deg., and naturally the hardness varied with the temperature of the quenching bath. However, quenching with the bath at 350 deg. gave us greater hardness than we ever obtained by quenching in oil, and more important, there was practically neither warpage nor distortion, the prevention of which was the real purpose in view. The whole job was an improvement over the quenching in oil method and gave us a harder steel practically free from distortion and devoid of any soft scale.

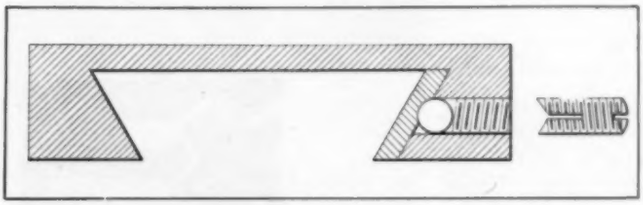
The punches and dies in question were for use in working thin aluminum, and distortion made it hard to salvage them. The steel was heated to the same temperature as for quenching in oil, care being taken that the temperatures were correctly registered.

A few test specimens run through at various temperatures of the quenching salts will readily establish to anyone the best procedure adapted to his needs. If anyone has tools that appear extremely risky to harden, where breakage and distortion are bugaboos, I would suggest that he familiarize himself with the method described. I believe that if he uses it, the tools will come out of the quenching bath with gratifying results.

Preventing Screws from Working Loose

RICHARD H. KIDDLE
Kiddle's Machine Tool Works

We were troubled by the gib screws in the cross-slides of our lathes working loose. We shortened the screws and countersunk and slit the inner ends, as indicated in the sketch. Before replacing the screws, we placed steel balls in the countersinks and tapped them with a hammer



enough to open the slits slightly. In replacing the screws, we first dropped a steel ball in each hole, and the screws were brought up tightly against the balls. Tightening the screws to adjust the gibs caused the balls to expand the ends and prevent them from working loose.

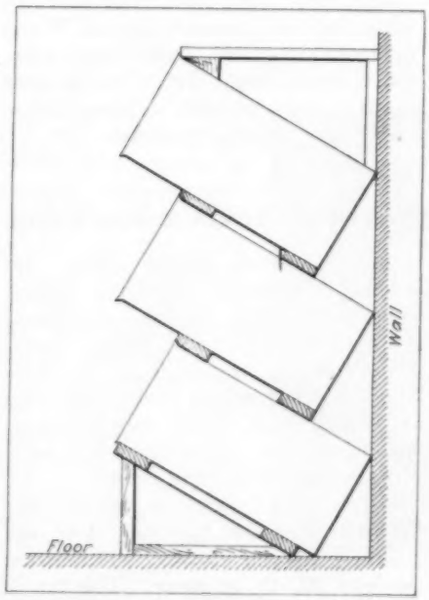
And speaking of gibs, the proper place for them is on the headstock side of the cross-slide. In this location, neither the gibs nor the screws have to bear the brunt of the pressure caused by the longitudinal feed. Of course the screws are not quite so convenient to get at.

Shop Bins From Old Cans—*Discussion*

E. BRINDLEY
Birmingham, England

In an article under the title given above (*AM*—Vol. 74, page 989), Frank C. Hudson gives an account of how old varnish cans are used as storage bins in a certain shop. His article reminds me of my use of old 5-gal. petrol (gasoline) cans in my home, workshop, and office.

After the tops have been removed, the cans are stacked in echelon, as shown in the sketch. Cleaning out the gasoline is an easier matter than cleaning out varnish from old cans. In fact, unless the cans are to be used in the house they need not to be cleaned at all, since what little gasoline is left in them will soon evaporate, and the odor is not objectionable in the shop. However, if the cans are not cleaned, an open light should not be brought near them until all of the gasoline has evaporated.



SEEN AND HEARD

JOHN R. GODFREY

Fooling Yourself on Figures

"Cost accounting," says a somewhat cynical friend, but one who has had a wide experience, "is a game where you try to fool everybody, including yourself. You charge off from 5 to 20 per cent a year for depreciation and then figure the equipment isn't costing you anything when it's off the books, overlooking excessive maintenance and lower production because they are charged on some other page. Your books show a nice reserve fund for new machinery, but you know it isn't available because it's paid out in dividends. You balk at increased overhead when every reduction in labor cost is bound to boost overhead as long as you use labor as the yardstick."

He said plenty more, but there's a lot of food for thought in this. Money in the bank at the end of the year means a lot more than fancy statements of depreciation, amortization and the like. In too many cases statements hide just the facts you ought to know.

Where Quantity Counts

Men from large production plants frequently make serious mistakes when transplanted to a small shop. They are accustomed to studying operation and direct labor costs rather than the cost of equipment and the charges that go against it. Similar pieces were tooled in two shops. In one the equipment cost $30,000 and the labor was only 21 cents per piece, while in the other the labor cost was 49 cents but equipment cost but $3,000. The higher labor cost was fully justified in the latter case as only 3,000 pieces were required. The increased labor cost was only $840 while $27,000 was saved the capital account. Here is where the manager has to play Solomon to keep business going.

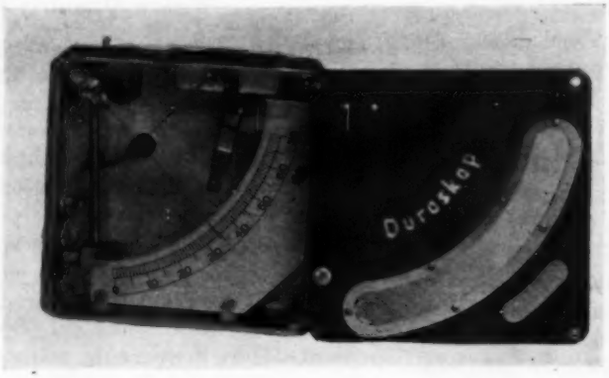
May We Interrupt

Open Sesame doors, automatic counters, color separators, magic crossing signals and a few other items from the Arabian Nights have become practical with electronic tubes of one variety or another. Recent among the applications of the Thyratron or power control tube is that of creating as many as 1,000 interruptions per minute for spot or intermittent line welding. The Thyratrons are a part of the control unit that supplants the contactors for interrupting the flow of current, eliminating contactor wear and providing higher speeds. Another application has to do with pipe finishing. Oil pipe-line pipe is finished true and beveled on each end for welding. The work is done in a center chuck machine in which pipes of varying length are chucked only approximately by the middle. Two tool carriers run in at high speed until they are $\frac{1}{8}$-in. from the end of the pipe when they suddenly slow down to the cutting speed. There are no dogs, cams or other mechanical "gadgets" used on these machines, for the pipe breaks a beam of light that is riding with the tool carrier. By way of Thyratrons, the motor control is shifted from high speed to cutting speed when the light is interrupted. There is thus no wear, noise or adjustment involved.

SHOP EQUIPMENT NEWS

"Duroskop" Portable Hardness Tester

The R. Y. Ferner Co., 1129 Investment Bldg., Washington, D. C., is placing on the market in the United States and Canada a hardness tester which uses the principle of a falling pendulum. This instrument is portable. Tests can be made very rapidly since the entire procedure consists of holding the Duroskop against the piece to be tested and pressing a button on the back of the case to release the pendulum. The pendulum strikes through a hole in the edge of the case against the workpiece and, in rebounding it carries with it a light pointer which remains at the highest point on the scale to which the pendulum rises. The rebound is in proportion to the hardness of the piece.



The pointer is pivoted at the center of the arc of the scale, and is lightly prevented from shifting by a wire stretched across the pointer. When a reading has been made, the pendulum is readily restored to its upper position by turning a spring-actuated lever. A leaf spring engages and holds the pendulum ready for the next test. The pointer is also carried along to the upper end of the scale. The section of the scale just beyond the 70-deg. mark is bent upwards, and when the pointer reaches this inclined surface it is raised out of engagement with the pendulum and can be quickly brought back to the zero position by a lever on the front of the instrument case.

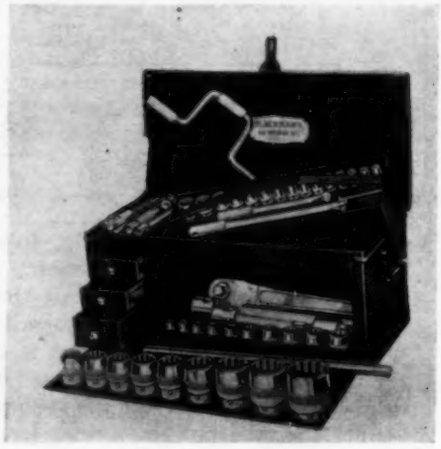
The V-grooves in the edge of the instrument permit it to be placed against cylindrical pieces in either a horizontal or a vertical position. Thus, the instrument is useful for checking case-hardened rollers. Exact adjustment is easily effected with the aid of a built-in level.

When necessary the instrument can be placed on top of the work-piece and the pendulum allowed to fall and strike the upper surface of the piece. Readings obtained in this manner are smaller than when the instrument is held against the side of the workpiece, but the relationship between the readings can be obtained by a curve.

The Duroskop does not mar the surface of the piece being tested, and it usually requires a hand glass to detect the point at which the blow was struck. Very thin material, less than 0.002 in. thick, can be successfully tested. The instrument is complete in itself and weighs less than 13 ounces. Measurements of the device are $4\frac{1}{8}$ in. square and $1\frac{1}{4}$ in. thick.

Blackhawk No. 48WD Industrial Wrench Chest

A wrench set, designed for millwright work, industrial maintenance, and other service work, has been developed by the Blackhawk Mfg. Co., Milwaukee, Wis. This No. 48WD set is a practical combination of handles and sockets. The socket

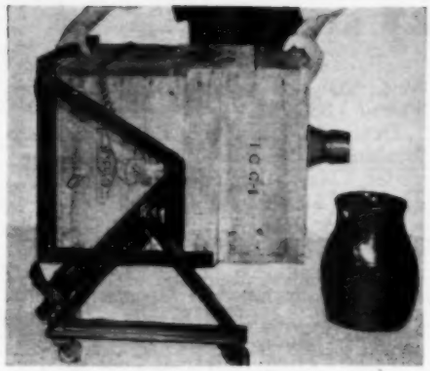


wrenches are equipped wth the "Lock-On" drive, which prevents them from slipping off accidentally. The sockets range from $\frac{7}{16}$ to $1\frac{1}{8}$ in., double hexagon, in the standard series with $\frac{1}{2}$ in. sq. drive; $1\frac{1}{4}$ to $2\frac{3}{8}$ in., double hexagon in the extra-heavy-duty series with $\frac{7}{8}$ in. sq. drive; and $\frac{3}{8}$ to 1 in., double square, in the standard series with $\frac{1}{2}$ in. sq. drive. This covers practically all nuts, bolts and capscrews in the U.S.S., S.A.E. and new American standards from $\frac{1}{4}$ to $1\frac{1}{2}$ in. A complete selection of handles, extensions, ratchets, and speeders is provided. The assortment comes packed in the "Big Chief" "W" case. This chest—with drop front, removable tray, three pull drawers and fixed tray—provides ample room for all tools, and extra equipment such as pliers, hammers, and stillson wrenches.

Schwenk Acid Carboy Tilter

An improved carboy tilter, designed to prevent accidents during handling of acids, has been announced by the Schwenk Safety Device Corp., 27 Water St., New York, N. Y. This tilter is designed to enable one man to safely truck, drain and otherwise handle carboys of liquids. It is suitable for use in plating rooms.

The carboy is elevated into the tilter by levers. The operator does not directly lift the carboy, which often weighs 200 lb. or more. The cradle



wherein the carboy box rests provides support on three sides and the bottom, so that there is no danger of the bottle dropping through the box should the wood be in bad condition. Full control in pouring is had at all times, and the contents can be completely drained from the bottle.

"Lindewelder" Oxy-Acetylene Welding Blowpipe

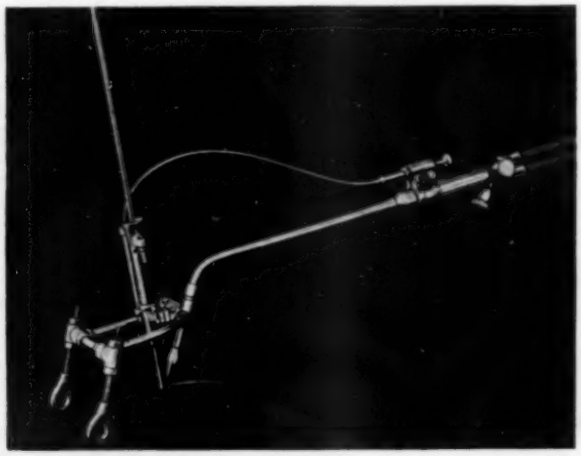
For welding by the "Lindewelder" process, the Linde Air Products Co., 30 East 42nd St., New York, N. Y., has introduced an oxy-acetylene welding blowpipe known as the "Lindewelder" and designated as the Oxweld Type W-21. Through the use of this device, the Lindeweld process becomes almost automatic. Welds of better quality are produced at greatly increased speed.

The device is a two-flame blowpipe with a rod holder, which feeds the welding rod automatically by gravity. A rod-lifting device controlled by a trigger on the blowpipe handle permits the operator to raise or lower the welding rod as required in starting and completing the weld, in passing over tack welds, and in changing rod. A carriage having two adjustable runners supports the blowpipe during the welding operation. This feature provides greater ease in manipulation and comfort for the operator.

Two separate flames are utilized in the Lindewelder, one for preheating the welding rod and one for performing the actual welding operation. The upper, or preheating, flame is so adjusted that the inner cone impinges directly on the rod as it emerges from the lower end of the rod holder, preheating it nearly to the melting point.

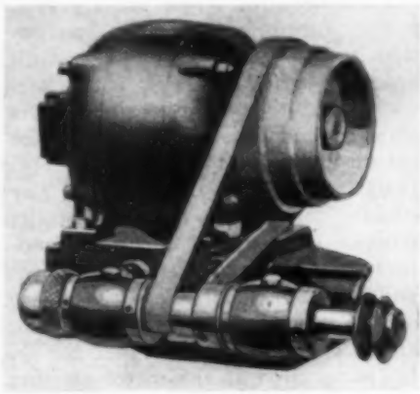
In the operating position, the Lindewelder is supported by the carriage with the runners straddling the weld directly behind the welding puddle. The runners can be adjusted in length and angle, making it possible to maintain the proper position for all types of work. Position of the rod is such that it shields the flame from blowing backwards onto the molten puddle, thus permitting the weld to solidify rapidly, giving greater speed and uniformly producing a typical machine-made joint.

Oxweld No. 24 welding rod has been developed specially for use with the process and must be used with the Lindewelder in order to obtain best results. It is available in three sizes, $\frac{1}{4}$, $\frac{5}{16}$ and $\frac{3}{8}$ in. to fit the corresponding rod holders. Welding tips Nos. 9 to 13, inclusive, and preheating tips Nos. 4 to 8, inclusive, are available for the type W-21 Lindewelder.



Layth-Grindar Improved Lathe Grinder

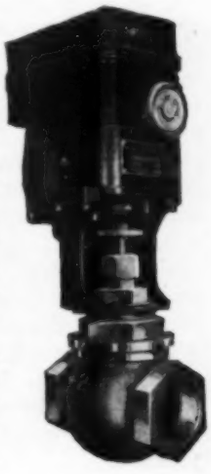
Improvements have been made in the line of precision grinders for engine and bench lathes as manufactured by the Layth-Grindar Corp., 28 Canfield St., Orange, N. J. One of the most important improvements is the substitution of the three-step cone pulleys for the two-step pulleys formerly used. In addition to the three spindle speeds thus obtained, two additional speeds can be had by reversing the spindle pulleys. For example, on the $\frac{1}{4}$-hp. unit illustrated, a spindle speed range can be had of 9,000, 7,250, 6,000, 5,300 and 4,200 r.p.m. from the one standard pulley equipment. Two advantages result from this change. First, it is easier to get the most nearly correct cutting speed from a wheel of a given diameter. Second, longer wear can be had from a wheel, because as the diameter is reduced by wear the proper cutting speed can still be had. This three-step pulley is furnished only on the $\frac{1}{2}$ hp., $\frac{1}{4}$ hp. and the two $\frac{1}{8}$-hp. engine lathe sizes. It is of no great advantage to have a wide speed range on the large 1-hp. engine lathe unit or on the 1/20-hp. and 1/30-hp. bench lathe units.



A bulletin describing these lathes is now available.

"Automatic" Type 1 Automatic Control Valve

The Automatic Temperature Control Co., Inc., 34 East Logan St., Philadelphia, Pa., has added to its line of motor-operated controllers a compact unit known as Type 1, which is designed to handle valves of either the rotary or slide-stem types. This controller is shown mounted with a single-seated, type GS globe valve as supplied for high-pressure gas, using inspirator burners. For low-pressure gas using inspirator-type burners, a type BP butterfly valve is available, while for steam or water at pressures up to 250 lb. per sq.in., a type GSP globe valve having a single-seated pilot is recommended. On gas-fired installations,



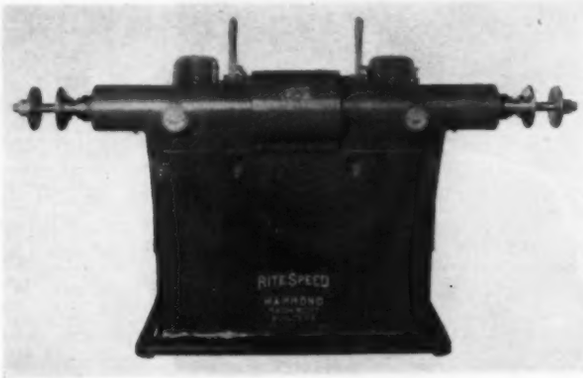
bypass piping and hand valves can be eliminated, as provision is made at the control valve for minimum fuel supply. The controller may be located in either a vertical or a horizontal pipe line.

In design, the screw shaft geared to the motor imparts straight-line motion to the operating yoke, which opens or closes the valve in two seconds. Positive valve positioning is assured, and declutching takes place before the motor comes to rest. This design prevents valve jamming or sticking at either extreme of its stroke. A fractional turn of the motor shaft operates a transfer switch built into the controller, and hence only momentary contact is required at the actuating instrument. No relay is required as the motor starting current is but 0.15 amp.

Hammond "Rite Speed" Type CCO Polishing and Buffing Lathe

Two independent overhanging spindles are used in the Type CCO "Rite Speed" polishing and buffing lathe announced by the Hammond Machinery Builders, Inc., Kalamazoo, Mich. This machine is designed for use with either two 3, two 5, two 7½ or two 10-hp. motors. The two-motored design offers the convenience of having overhanging spindles with a maximum working clearance around them.

Each spindle has its own motor, starter, multi-V belt, switch and brake. Each spindle can be operated independently of the other, consequently the machine is recommended where wheel changes are frequent or the operation requires two different speeds. Belt tension for the belts of either motor is effected by means of a screw-feed slide rail. The machine can be supplied with the standard oiling system, or with a cascade oiling system. Glass-front, oil-level gages and pressure indicators are part of the oiling system. The spindles overhang 8 in. from the center of the spindle to the front of the pedestal.



PATENTS

NOVEMBER 10, 1931

Metal-Working Machinery

Gear Cutting Machine. Ernest L. Fickett, Linus E. Greene, Vladimir Charushin, and James S. Campbell, Fitchburg, Mass., assigned to Scurlock Gear Corporation. Patent 1,830,753.

Metal-Working Mechanism (Slitting). Robert S. Allyn, Brooklyn, N. Y., assigned to himself as trustee. Patent 1,830,778.

Cutting-Off Machine. John G. Kay and Louis C. Scheuring, Detroit, Mich., assigned to Ainsworth Manufacturing Corporation. Patent 1,830,876.

Table Feed Mechanism For Grinding, Smoothing and Polishing Apparatus. Seraphin Werotte, Auvelais, Belgium. Patent 1,830,895.

Method Of And Apparatus For Grinding Gears. Frederick E. McMullen, James E. Gleason, and Arthur L. Stewart, Rochester, N. Y., assigned to Gleason Works. Patent 1,830,952.

Method Of And Apparatus For Grinding Gears. Herbert Edgar Taylor, Coventry, England, assigned to Gleason Works. Patent 1,830,971.

Apparatus For Forming Sheet Metal. Walter E. Richter, Shorewood, Wis., assigned to A. O. Smith Corporation. Patent 1,831,033.

Roll Grinding Machine. Harrison R. Williams, New York, N. Y. Patent 1,831,085.

Hack Saw Sharpening Machine. Emanuel Stauder, Rochester, N. Y., assigned to Huther Brothers Saw Manufacturing Co. Patent 1,831,204.

Apparatus For Grinding. George T. Huxford, Providence, and Frank E. Stratton, Cranston, R. I., assigned to Diamond Machine Co. Patent 1,831,353.

Drilling Machine. Clark Scholl, Springfield, Ohio, assigned to The Steel Products Engineering Co. Patent 1,831,547.

Tools and Attachments

Cutting And Flanging Tool. Joseph Zang, St. Louis, Mo. Patent 1,830,865.

Chuck. George M. Class, Madison, Wis., assigned to Gisholt Machine Co. Patent 1,830,981.

Device For Removing Ball Races And Bushings. Herbert I. Holland, Worcester, Mass., assigned to Daniel A. Holland, Sr. Patent 1,831,003.

Cylinder Hone. Ernest A. Hall, Toledo, Ohio, assigned to The Hall Manufacturing Co. Patent 1,831,172.

Chuck Closing And Opening Mechanism. Fred H. Bogart, Shaker Heights, Ohio. Patent 1,831,225.

Full Floating Universal Tool Holder. Emil Gairing, Detroit, Mich., assigned to Gairing Tool Co. Patent 1,831,382.

TRADE PUBLICATIONS

BORING MACHINE. The Ex-Cello-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich., has issued a Bulletin DB-2131 on its Style No. 216 precision boring machine, recently described in these pages. The bulletin gives a most complete discussion of the constructional features of this machine, the types of work which can be done upon it, and many photographs of important assemblies.

DRILL JIG BUSHINGS. The Acme Industrial Co., 413 N. Carpenter St., Chicago, Ill., has published a net price list, dated November 1, 1931, on standardized drill jig bushings, the most complete list it has ever issued. There are 21 groups and 8 types classified.

HOISTING AND CONVEYING EQUIPMENT. The Wright Manufacturing Co., Bridgeport, Conn., has issued Catalog No. 15, showing each type of Wright hoisting and conveying equipment, and giving brief descriptions. Among the types of equipment included are: hand-operated chain hoists, trolleys, trolley hoists, traveling cranes, jib cranes and electric hoists.

LIFT TRUCKS. The Yale & Towne Manufacturing Co., Philadelphia Division, Philadelphia, Pa., has issued descriptive folders of its line of hand lift trucks. Folder No. 1 describes the Blue Streak Stuebing Line with capacity of 2,500 lb.; Folder No. 2, the Red Streak Stuebing Line, with capacity of 3,000 lb.; and Folder No. 3, Models "G" and "L" Cowan trucks, with capacities of 4,000 and 2,000 lb.

MOTORS. The Wagner Electric Corporation, St. Louis, Mo., has published Bulletin No. 167 on small motors, giving electrical characteristics and construction information.

RECORDING INSTRUMENTS. The General Electric Co., Schenectady, N. Y., has issued Bulletin No. GEA-1061D, superseding 1061C, on Type CD recording instruments for alternating- and direct-current systems.

Reference Book Sheet

MAGNESIUM AND ITS ALLOYS

Magnesium, lightest of all known metals, is one of the most plentiful in the earth's crust. It is only two-thirds as heavy as aluminum, one-fourth as heavy as iron, and one-fifth as heavy as copper. Due to its great affinity for oxygen, it is used as a deoxidizer in melting copper, brass, and nickel. When pure, it is a lustrous silvery-white metal with a melting point of 1,204 deg. F., only 16 deg. below that of aluminum. But when heated in the air to a point slightly above the melting point, it burns with a brilliant white light, resulting in its use for fireworks and flashlight powders. Its tensile strength cast is 13,000 lb. per sq.in., and extruded is 28,000 lb. per sq. in. First obtained in 1808, it has only recently attained importance commercially, due principally to the increasing use of extremely light parts for aircraft, automotive, high-speed reciprocating, and portable units. Commercial application on a large scale was forced to wait upon lower manufacturing costs and the development of high-strength alloys. Both of these preliminary steps have now been accomplished.

Alloys

Alloys of magnesium have been developed with physical and mechanical properties that fit them for a wide variety of engineering uses. They possess a degree of strength, toughness, and fatigue endurance in relation to weight that enables them to compete successfully with other structural metals. They are used as castings, forgings, in the wrought and extruded form, and more recently in drop forgings and die castings. Cast magnesium alloys have the same tensile strength as other cast light alloys and are superior to other cast metals when compared on an equal weight basis. Wrought magnesium alloys are likewise equal or superior to other wrought structural alloys on an equal weight basis. They neither airharden nor "grow." Magnesium alloys, furthermore, are among the most permanent of the common engineering metals when subjected to atmospheric exposure. Their durability is likewise enhanced by the complete absence of intercrystalline corrosion. Where corrosive conditions are severe, however, the alloys must be given suitable protective coatings. They have their greatest application in parts operating at relatively low temperatures, where strength and lightness are the main considerations and where high thermal conductivity is of secondary importance.

Proportions

Except in alloys magnesium is not used commercially in the making of parts. The usual alloying metal is aluminum, the proportions generally varying from 88 to 96 per cent of magnesium and from 4 to 12 per cent of aluminum, with slight additions of manganese, cadmium and copper, depending upon the alloy. For example, an alloy containing 95.7 per cent magnesium, 4 of aluminum and 0.3 of manganese is used for forging, rolling, and extrusion where maximum ductility is required. Reducing the magnesium to 93.7 and increasing the aluminum to 6.0 produces an alloy for castings requiring good strength without heat-treatment, and for mechanically worked parts requiring both strength and ductility. A further reduction of magnesium content to 91.8 and an increase of aluminum to 8.0, with manganese at 0.2, produces high-strength heat-treated castings and mechanically worked parts requiring maximum strength, while reduction of the aluminum to 2.0 and an addition of 2 per cent of cadmium and 4 per cent of copper produces an alloy for pistons and other parts requiring maximum thermal properties. An alloy of 98.5 per cent magnesium and 1.5 manganese gives maximum corrosion resistance, it being primarily for cast and fabricated parts not subjected to maximum stresses.

Strengths

Sand castings of the second composition have a tensile strength of 28-31,000 lb. per sq.in. Those of the third have a tensile strength of 24-27,000, which can be increased to 31-35,000 by heat-treatment. The fourth has a tensile strength of 22-25,000, and the last a tensile strength of 18-20,000. Sand castings with 88 per cent magnesium and 12 per cent aluminum have tensile strengths of only 19,000 lb. per sq.in., but when heat-treated show strengths up to 31,000 lb. per sq.in. This same alloy, when extruded, has a tensile strength of 45,000 lb. per sq.in., and in rolled sheets a strength as high as 53,000 lb. per sq.in. Increasing the proportion of magnesium and lowering that of aluminum generally decreases proportionally the tensile strength of the alloy. One usual magnesium aircraft casting alloy is composed of 7 per cent aluminum, 0.4 per cent manganese, and the balance magnesium; has a tensile strength of 28,000 to 33,000 lb. per sq.in. heat-treated and a yield point of 9,000 to 11,000 lb. per sq.in., with a Brinell hardness of 50, a modulus of elasticity of 6,500,000 and an endurance limit of 9,500 lb. per sq.in.

Casting

Magnesium is more sensitive than aluminum to small radii and sharp corners in castings, probably for the reason that its lower elastic modulus permits a greater deformation under a given load, resulting in a greater concentration of stresses at such points. By providing generous radii in the castings and by employing careful machining practice, this difficulty can usually be eliminated. In some instances it is necessary to increase the section in magnesium castings by about 15 per cent in order to make the stiffness comparable to that of aluminum. It is not necessary, of course, to add metal all over the casting but only in critical sections where excessive deformation may be occurring, so that the additional weight usually does not amount to more than five per cent, resulting in a net saving over aluminum of from 25 to 30 instead of 30 to 35 per cent. Necessary changes in aluminum pattern equipment for the production of satisfactory magnesium castings can usually be made at relatively small cost. The shrinkage allowance is $\frac{3}{16}$ in per foot greater than for aluminum, making the allowance $\frac{5}{16}$ in. per ft., but unless the particular casting is quite long this usually gives no trouble. Because magnesium castings are much softer than those of aluminum it is sometimes necessary to increase the number or size of the studs used. Larger seats are desirable for bolt heads and washers where pressures are heavy.

Heat-Treating

In heat-treating magnesium alloy castings it is only necessary to hold them at a temperature of about 800 deg. F. for a short period of time. If the piece is cooled rapidly after treating, a hardening effect takes place.

Forgings

Up to the present time there has been very little commercial application of magnesium alloy forgings, because the art of producing them has not been sufficiently

(Continued on next page)

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MAGNESIUM AND ITS ALLOYS

advanced. It is now possible, however, to forge practically any shape in magnesium which can be produced as an aluminum alloy forging. Experience to date plainly indicates the necessity of stiffening the magnesium forging sufficiently to make it equivalent to aluminum design. Large bearing surfaces, with low unit pressures, should be provided where parts are bolted together. Liberal-sized bosses should be provided for studs, which should not be driven too near a hole or an unsupported edge.

Machining in General

Magnesium alloys are easiest of all metals to machine. They take a fine smooth finish, and the work can be easily held to exact dimensions. There is no tendency to drag, tear, or chip out. The work does not heat up as much as other metals. Sand castings should be sand-blasted or pickled in sulphuric acid before machining to remove adhering sand from the surface of the metal.

Ordinary carbon steel tools can be used satisfactorily. High-speed tools are preferable for production work, and tungsten-carbide tools offer certain advantages. Cutting tools should be ground at about the same angle as is customary for brass, with perhaps slightly more rake. They should be kept very sharp and, so far as possible, used only on magnesium. Honing is recommended, particularly for fine finishing cuts where accurate dimensions must be maintained. Unlike tools for brass, usually ground with a rather coarse abrasive wheel, magnesium cutting tools should be finished with a fine abrasive wheel and the edges should be dressed with an oil stone to remove burrs, wire edges or grinding wheel marks. These recommendations apply particularly to lathe, planer and shaper tools, and also to a certain extent for most other types of tools, including special forming tools, milling cutters, drills, and threading tools. For average turning, a round-nose tool will give good results. It should have a side slope of 12-15 deg. and a clearance of about 12 deg.

Milling, Drilling, Tapping

Milling cutters of the spiral fluted type with about 15-deg. spiral, such as are used for steel, are recommended for magnesium. It is important, however, that coarse-tooth cutters be used. For cutters 3 in. or larger in diameter, a 4-deg. clearance angle is used; for smaller, a 6-deg. angle. Reamers for either hand or power reaming should also be of the spiral fluted type. Expansion reamers are recommended, as this permits the maintaining of a honed cutting edge without excessive scrapping of reamers. Standard practice is to leave about $\frac{1}{64}$ in. of material to be removed by the reamer. For drilling, the ordinary twist drill works very satisfactory. Carbon steel drills may be used, cutting at 150 ft. per min. Pratt & Whitney Aircraft uses a straight-flute drill with a metal shaped cutting point. Drills and reamers intended for machining magnesium alloys should not be used on other metals.

Drilling and tappings practice should conform to that for aluminum. A comparatively heavy feed may be used, with speeds approximately the same as those for drilling brass. Taps such as are used for steel may be used, and S.A.E. fine threads are recommended. "Spud" taps, often used for brass, are also satisfactory for magnesium. The depth of tapped holes for studs should be three times the diameter of the stud.

Magnesium alloys may be sawed very readily with band or power saws. High-speed metal-cutting bandsaws cutting at speeds of about 5,000 lineal ft. per min. or circular saws operating at speeds of about 10,000 lineal ft. per min. may be used. With these speeds, a coolant such as soluble cutting compound is used to decrease the fire hazard.

In general, cutting speeds approximately the same as for brass may be used for magnesium. Fairly heavy feeds and deep cuts can be used for rough cuts in many classes of work. Light cuts are necessary for fine finish work. It should also be appreciated that magnesium springs away from the tool more than most other metals. This makes light cuts especially necessary when turning more flexible parts where the ratio of length to diameter is high.

In turning, both the speed and depth of cut can be increased over the usual practice in machining other metals. As a rough comparison, the magnesium alloys can be machined about three times as rapidly as cast iron. Roughing operations use speeds of from 200 to 600 ft. per min., with a cutting depth of $\frac{1}{8}$ to $\frac{1}{4}$ in., while finishing operations generally use speeds of 1,000 to 1,400 ft. per min., with a cutting depth of $\frac{1}{64}$ to $\frac{1}{32}$ in. Cuts as deep as $\frac{1}{4}$ in. can be made with a $\frac{1}{32}$-in. feed, but for finishing work fine feeds are recommended.

Fire Hazard

For all ordinary machining operations, a cutting compound or lubricant is not required. However, for high-speed screw machine work, lubricants should be used to prevent overheating, and for drilling and tapping a lubricant or coolant is often desirable. A mixture of lard oil and kerosene of about equal parts has been found quite satisfactory. It should be appreciated that, in cutting operations where heat is apt to be generated, together with very fine cuttings, a fire hazard exists, and a coolant such as soluble cutting compound is then necessary.

Dry machining is desirable wherever possible in order to facilitate the economical recovery of scrap. However, where this is done, precautions should be taken to prevent fires which may be caused by the friction of dull tools when making fine cuts or from grinding sparks. Large accumulations of dry chips or sawdust beneath machines should be avoided. Scrap should be kept in covered dry containers. The best method of handling dry machine scrap is a suction system comprising a fan and a cyclone separator. In case of fire in magnesium turnings, water or other liquid extinguishers should not be used. A blanket of dry sand or dry Portland cement liberally applied has been found to be the best extinguisher. With reasonable care in machining and the handling of scrap however, no trouble will be encountered. Polishing stands and emery wheels operating on magnesium should never be used for any other metal unless the entire installation has been thoroughly cleaned.

Sheet Metal Working

Magnesium alloy sheet can be formed cold to a limited extent. Cold bends can be made around a radius which is 4 to 5 times the thickness of the sheet. Sharper bends and deep drawing operations must be done hot and with heated tools. Best temperature range for the hot forming of sheet is 500 to 700 deg. F. Care must be exercised not to heat the sheet above 800 deg. F. because of its hot-short properties. Spinning and drawing are impracticable due to the rapid hardening of the metal under cold work.

(To be concluded next week)

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AMERICAN MACHINIST

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

New York, November 19, 1931

VOL. 75 NO. 21

"Educational Orders as Unemployment Relief"

If you will permit the calendar to be turned back one year to November 20, 1930, you will recall our front page editorial which read in part:

"*American Machinist* recommends without reservation the passage of enabling legislation, as soon as the Congress meets in December, to authorize the Assistant Secretary of War to place so-called educational orders for munitions with private industry, and the appropriation of adequate funds to make them a factor in unemployment relief.

"Such orders would provide . . . work for deserving toolmakers and machinists now laid off, and are entirely sound from the national defense point of view . . .

"Many meritorious projects for providing work for the unemployed have been proposed, but analysis shows that most of them will help only the unskilled in all fields, and the skilled in the field of civil engineering and construction. We have seen little that would help the men in the metal-working industries. The educational order, however, will provide employment in metal-working plants, and if placed now will be welcomed by the management because there is no flood of production of the regular product to be disturbed . . . Unlike certain other relief projects, educational orders can be placed within a few hours after the enabling bill is signed."

And if you have followed these pages during the intervening twelvemonth you will know that *American Machinist* has not retreated one single inch. Events both national and international have but served to intensify the impregnable case and the necessity for educational orders.

Though the members of the late and unlamented Seventy-First Congress were far too busily concerned with their personal political fortunes to permit consideration of educational orders, an enabling bill will undoubtedly come before the Seventy-Second. Since it is almost sure that further economies in the Army and the Navy are in order, the War Policies Commission appointed by the Congress last session is considering further hearings on the educational orders plans that have been proposed. It is no secret that military men believe that reduction in the established forces makes it necessary to increase the scope of plans for mobilizing industry during times of national emergency. Thus budgetary reduction becomes an unexpected and potent ally of educational orders.

Legislation to authorize educational orders will at one stroke relieve unemployment and strengthen national defense. We urge your support and cooperation. In our words of last year, "Please give this proposal your careful consideration and write to your representatives in Congress urging their immediate and favorable action."

Automobile Replacements

Although the N.A.C.C. plan for simultaneous announcement of new automobile models did not —and probably could not—function one hundred per cent, a large number of makers will display their 1932 products between now and January 1. Some of these new creations are already in the dealers' show rooms. The attention given to driving convenience and fine appearance form the designers' answer to the spur of decreased sales. Cars have been fashioned to exert a real pull on the timid dollar.

With two subnormal years behind it, the automotive industry faces an unusually attractive replacement market. Purchasers of those five and one half million cars made in 1929 should be receptive to the lure of the 1932 models. Three years is below the life of the average car, but it is as long as the first owner usually cares to drive

it. Then there are those deferred replacements of still older cars, whose owners were influenced by the depression psychology of 1930 and 1931. The wear and tear of another winter will make it exceedingly hard for them to drive past a new car display, from either a mechanical or a personal viewpoint.

All in all, the automobile makers' prospects look bright for next year. Equipment purchases, by some of them, reflect their confidence that 1932 will easily better the two years preceding it. Probably much of the business will be in the lower price ranges. But this also has been anticipated by the increased number of manufacturers who will compete in the lowest bracket.

◂◂ CHIPS ▸▸

Although the plots and counterplots and diplomacies of the Sino-Japanese affair continue to remind one of a Gilbert and Sullivan opera, it becomes ever more clear that, whatever it be termed, a state of war exists . . . brings to mind what one competent observer stated after the Great War . . . that there would probably never again be a formal declaration of war . . . Tokyo says that U.S.S.R. has an army in the field . . . Moscow denies . . . Professor Orchard of Columbia points out Japan's poverty in fuel and iron ore . . . states in "Japan's Economic Position" (Whittlesey House): "Japan is a powerful nation only in comparison with other countries of Asia, and that an inventory of her resources clearly shows Japan could not carry on a war with a major power." . . . It will take more than the League of Nations to keep her needy millions away from the fuel and iron and food of Northern Manchuria . . . Nevertheless, Ambassador Dawes brings himself and his pipe to the League's aid . . . France and Germany continue reparations conversations . . . The former begins to feel pinch of deflation . . . the latter is uncertain but not gloomy . . . England is confident, even buoyant . . . launches pre-Christmas "Buy British Goods" campaign . . . Canada, on the upgrade, to use 125,000,000 dollars for public works and unemployment relief . . . France considers 180,000,000 dollar public works program . . . Wall Street suspects that Soviets are buying czarist Russian bonds at three cents or less on the dollar . . . would take about 2,000,000 dollars thus to retire original 75,000,000 . . . and would certainly be smart business.

President Hoover puts in a busy week, preparatory to welcoming Signor Grandi . . . works on his message to Congress . . . announces home loan plan calculated to defrost two billion dollars worth of real estate assets . . . cuts Naval budget 59,000,000 and brings it 17,000,000 below current appropriations . . . no Navy Yards to be closed; no personnel to be let out . . . Secretary Adams approves . . . Admiral Pratt, Chief of Naval Operations, says he favors orderly fifteen-year construction program rather than a race to build to treaty limits . . . National Credit Corporation makes its first loans five weeks after Hoover's initial announcement . . . says that requests for loans are few and far between . . . Currency circulation declines still more showing that hoarding is less popular.

Patrick E. Crowley will resign presidency of N. Y. Central, January 1, 1932 . . . will be succeeded by Frederic E. Williamson, president of C.B.&Q. . . . he in turn, by Ralph Budd, president of Great Northern . . . Railroad heads unite to deal with I.C.C. on rate increases and to dicker with twenty-one unions on wage adjustments . . . I.C.C. will begin hearings on 4-system railway plan on January 6 . . . Yale & Towne concentrates production of its material handling lines in new Philadelphia plant . . . 22 individual buildings; 4 acres of floor space . . . Gerard Swope replies to critics of his plan . . . Dr. Calvin E. Rice, devoted secretary of the A.S.M.E. for twenty-five years, will be made an honorary member at the forthcoming annual meeting . . . Christmas Clubs will distribute 600,000,000 dollars during the next two weeks, and some of it is bound to filter through to our industry.

THE VOLUME INDEX

Work is now going forward on the index for Volume 75 which will, of course, be completed with the last issue of December. The index will be ready to mail shortly after the first of the year to a standing list of those readers who wish copies. If you have not been receiving an index, and want one, please write to the editor.

It cannot be long now before improved retail business will be reflected more fully in the metal-working industries . . . Even Col. Ayres of Cleveland Trust admits that developments of past month are "encouraging rather than discouraging" . . . Canadian Pacific recalls 8,000 shop workers after two month layoff . . . Inland

Steel recalls 400 . . . Chevrolet reopens Buffalo plant . . . Carnegie Steel sends for 3,500 employees of its Braddock mill . . . American Can to recall thousands . . . Lehigh Valley orders twenty new high speed freight locomotives, ten from Baldwin and ten from American Locomotive . . . R. G. Dun's November index number shows rise of 3 per cent over October . . . Three Westinghouse Electric & Mfg. plants are increasing schedules—Swissvale, Wilmerding and East Pittsburgh . . . Radio Corporation earns 3,957,489 dollars for first nine months, 1931, against 870,753, same period, 1930 . . . For third week in succession steel operations increase.

HANGARS FOR SHOWS

January next, the American Road Builders' Association will hold its meeting and machinery show in an airplane hangar at Detroit. This, we are inclined to believe, is a brand new idea with unlimited possibilities. Numbers of machinery builders will realize instinctively that a hangar is ideal for a machinery show. There is no question of floor loads; the ample doors and entrances at grade make it easy to place bulky exhibits. And what village or hamlet is without its hangar?

THIS WEEK IN *AM*

Something about the very title, "Replacement by Formula," whets the imagination. Somehow one feels that the dream of the philosopher has in part come true; in at least one organization, reason, as expressed symbolically in an equation, has replaced hunch. We wish to acknowledge our indebtedness to R. F. Runge, vice-president, SKF Industries, Inc., for his presentation of the SKF equipment replacement policy. It is obvious, of course that this entry for the *American Machinist* Awards is one of the eight papers selected by the Committee on Awards for final consideration. As previously announced, all the six runner-up papers are being published alphabetically by classes.

"Twice-Used Heat" (page 767) describes one of those tantalizing things that make almost any man wonder why in thunder he did not think about it himself. Yet just such an application of intelligence may often mean the difference between red figures and black in plant operation. The author, J. B. Nealey, is no newcomer to these pages. His work with the American Gas Association permits him to uncover many profitable ideas that would be unavailable to the average plant visitor.

Who should bear the brunt of lowered profits? The Executive Forum (page 768) presents a vital problem for your best thought and comment.

Ask ninety-nine men out of one hundred, and they will tell you that die making simply cannot be put on anything but day work. No Sir. But Ellsworth E. Clark, foreman of die design, Westinghouse Electric & Mfg., comes right along and tells you just how to apply incentives to that very thing. His article (page 771) will undoubtedly raise discussion, but he can turn to his own experience for proof.

The author of "Modified Gravity Curves" (page 778), is an active and versatile member of fine design and precision machines, Hartford, Conn. Richard Saunders, who provides "Mechanization Increases Industry's War Time Task" (page 778), in an active and versatile member of the McGraw-Hill staff, Washington, D. C. And L. M. Curtiss, whose "Machine Gas Cutting" (page 784) opens up many a possibility for you, is superintendent of 140- and 206-in. rolling mills, Lukens Steel Company.

• COMING •

Since the news has already been announced, it will take no prophet to tell you what will be the leading article in the forthcoming issue of November 26. The *AM* Award brief of the Blanchard Machine Company is well on its way through the composing room and will positively appear. The next in the alphabetical-by-classes program will be the Warner & Swasey brief.

Second in interest only to the equipment replacement brief in next week's issue will be a fact-finding article on the moot subject of introducing color into the shop. Herbert Chase, consulting engineer and former associate editor of this magazine, has made searching inquiry in every metal-working plant rumored to have gone "color-conscious." His findings will send many a works manager on the dead run for the nearest paint and varnish establishment.

In addition you will find articles on press tools for manufacturing light steel frames; on certain difficult problems in locating drill jig bushings; on a different type of gear tooth comparator; on making and keeping locomotive crankpins square —a symposium of methods used by a baker's dozen of railroad shops; on handling small parts in storage. Whatever your interests in the industry, you will find something of definite value next week.

THE . INDUSTRY .

Progress in Metal-Working and Machinery Markets

BETTERMENT in general conditions and in tool sales in many districts contrasts favorably with last month's N.M.T.B.A. report, which shows a decline in all indices . . . Districts are practically unanimous in reporting a pick-up in interest and inquiries and in some cases the closing of sales or renewal of inquiries almost a year old . . . The N.M.T.B.A. gross order index dropped to 44.5 from 56 for September, pulling the 3-month average down to 57.4 from 63.1 . . . All classes declined, Class A (More than $50,000 average monthly shipments) dropping to 40.3 from 50.2, Class B ($10-50,000) to 59.3 from 73.9, and Class C (Less than $10,000) to 54.1 from 72.2. Shipments declined from 91.8 to 84.6 and unfilled orders to 96.5 from 139.6, based on average monthly shipments of 1922-24 as 100.

NEW YORK dealers had several good-sized orders, principally from big industrial users . . . Philadelphia, with an order for 500 new subway cars, is otherwise unchanged . . . Cincinnati is receiving a few scattered single orders and a fair volume of inquiries . . . Detroit has some orders and better inquiries, future prospects looking good there and in South Bend, where Studebaker is reported to want about $300,000 more in new tools . . . Chicago has better inquiries.

CLEVELAND tool sales are to rubber tire, steel, and machinery manufacturers and the school board, while industrial prospects look good . . . Milwaukee's orders are diversified, small tool and standard lines going better . . . New England sales are for replacement principally, although small tools are going well and school inquiries are picking up . . . Southwest improvement is slow.

NEW YORK

Better feeling and some tangible evidences of improvement appeared last week. Several dealers got good-sized orders, some of them from large industrial users who just came into the market and some from inquiries outstanding for many months. One dealer even sold a $30 repair part quoted on last February. Some repercussions of the rumored Rockne car to be built by Studebaker are heard in the East, since an eastern body builder is reported to have some of the contracts.

PHILADELPHIA

An order for 500 subway passenger cars, received by the American Car & Foundry Co., Berwick, Pa., is the feature. The cars are for the New York subway system, and the cost is placed at $10,700,000, the new job to give employment to 1,500 additional men. Otherwise the situation remains unchanged. Sales managers and other executives of plants here are looking forward to the time when purchases of machinery now in the offing will become actualities.

CINCINNATI

The machine tool market still is befogged and business is hard to find. Manufacturers and selling agents received a few scattered orders, but with few exceptions the requirements were single items. A fair volume of inquiries was received, principally from miscellaneous small users whose needs were confined to a single tool for a special purpose.

DETROIT

A marked improvement is apparent in the business and industrial outlook. Few orders are being received for machinery and equipment, but dealers are more optimistic than at any time in the last few months. Inquiries are being received in greater numbers. Most of the equipment is for replacement purposes, but even this marks an improvement.

CHICAGO

Business in machine tools for the first ten days of November is reported to have shown no appreciable improvement. In some lines of equipment inquiries are said to be increasing in volume, regarded as an encouraging augury. An exception is a Midwest plant specializing in drills which had a distinct gain in both inquiries and sales since the first of the month. No confirmatory reports of a renewal of activity in farm implement and tractor plants are heard, but the impression that increased production of farm machinery is not far distant persists. Business in used tools is at a low level. The Chicago Board of Education wants a 32 or 36-in. by 10-ft. lathe.

CLEVELAND

The local machine tool industry presents a better picture than it has for several months. Sales are more active. Rubber tire, steel and machinery manufacturers have made purchases. The Cleveland School Board has closed contracts for $12,000 worth of tools for three new high schools. Factors that have helped to create better feeling include the fact that Ford Motor Co. is calling for bids on accessories from Cleveland producers, and Mahoning Valley steel manufacturers have opened five additional open-hearth furnaces due to the demand for sheet steel from automobile manufacturers. White Motor Co. has placed an order with an employment agency for thirty draftsmen with automotive experience.

MILWAUKEE

Signs of improvement are beginning to show themselves and the trade is more optimistic than it has been for some months. Although a lot of inquiries are not materializing there are orders being placed by diversified industries to keep things going. One manufacturer stated that the automotive and tractor manufacturers were constituting the bulk of his business. Improvement in demand for standard tools features conditions, with one concern which reports that the first two weeks of November almost equalled the total October volume. Selling agents of small tools report more frequent orders and generally better feeling.

NEW ENGLAND

The current week developed little action. Promising inquiries continue to indicate a broader buying program, which consistently fails to materialize. Orders are of the occasional variety and almost wholly for urgent replacements. The zest of the demand lies in this type of business and better than average distribution of small tools. Inquiries for manual training departments include six lathes, woodworking and printing equipment. Massachusetts is receiving figures until Dec. 1 for complete machine shop equipment, band saws, benches, a planer and turning lathe. Soviet Government orders, the principal business strength of Worcester builders and other centers for some time past, are now a negligible factor.

SOUTHWEST

The major metal-working industries exhibit no particular changes. In the main this is also true of the majority of the contract and specialty shops, as well as of tool shops and the like. Engineering and shop forces are being held to modest numbers, and development work as well as production waits upon a return to greater business activity.

WEEK . BY . WEEK

BUSINESS BAROMETER

Trends in General Business throughout the world

THEODORE H. PRICE
Editor, Commerce and Finance, New York

There can be no doubt that business sentiment has changed. In the United States the change is probably greater than in Europe or the Orient, but the whole world has been more or less affected by it, and the optimism recently counseled in these weekly reviews is now more readily accepted than at any time since the autumn of 1929.

For those who seek a reason for everything that happens, this change of feeling is attributed to the advance in silver and the essential commodities of civilization. But this explanation carries us only one step further, and leaves us without any special or peculiar reason for the rise in wheat, cotton, rubber, silk, hides, coffee, sugar and cocoa that recently has been recorded on the Exchanges where these articles are bought and sold for future delivery.

In the circumstances psychology supplies us with the only satisfying explanation of the quasi-boom that has been developed. Special reasons were educed for the rise in each particular staple: Wheat has been higher because the Russian supply proves to be smaller than had been expected. Cotton was up because some spinners are said to have been buying their supplies for years ahead. Corn, rye and most other cereals advanced in sympathy with wheat. Hides and leather were up because the demand for shoes showed a phenomenal increase. Sugar is gradually working into a stronger position as the Chadbourne plan comes into operation. Coffee has been firm because Brazil seems to be pretty well in control of the large supply. Silk had quite a substantial advance because war between Japan and China seems to threaten.

Some Later Recessions

Some of these commodities had moderate recessions later in the week. But the unanimity with which commodities have advanced recently is not explicable by a reference to these details. They have helped; but the underlying reason for the general higher price level is not in any sense technical. Fundamentally it is due to the advance in silver and the suspension of gold payments by England and all the other important nations of the Occident except France and the United States.

Just how long the two last-named powers can continue to meet their liabilities in gold is a question that no one can answer. Economists differ in their opinions. There is one group who insist that a bi-metallic standard of values that would embrace all the world is a sure cure for the monetary troubles that now confront us. There is another group who say that we can continue to use gold as a standard without putting it in circulation as "money for the masses." This suggestion sounds attractive, but it is difficult to see how it could be given effect without relinquishing control of the gold now in the central banks of the world.

Meantime, it seems reasonably certain that it will take at least a few months, if not a few years, to untangle the monetary knots that have been tied for us by precedent and tradition, and that an endless number of open and closed conferences will have to be held meanwhile. Hence it seems reasonable to expect that the question will absorb public attention for the present, and that it will be some time before any definite plan can be even tentatively accepted.

The Oriental Question

Of course, much depends upon the value of silver, and the war between China and Japan that seems to threaten increases the uncertainty of the situation in the Orient. Reliable news from Japan or China is very hard to obtain, and those who are familiar with conditions in the Far East tell us that many of the press dispatches cannot be relied upon. For those who have interests in either China or Japan a policy of watchful waiting seems to be the wisest to pursue.

In some quarters it is pointed out that foreign wars have generally meant an increased demand for American production, and some of last week's commodity buying was based upon this theory. The effect has been an improved demand for manufactured goods in both Europe and America, and business in the Northern part of the Western Hemisphere as well as in Europe is undoubtedly better than it was.

This improvement is reflected in the price of both stocks and bonds, and a further advance seems probable at least until interest rates are higher.

As the number of small banks that have suspended since the beginning of the year has been so frequently referred to as one of the most disturbing features in the situation, it is gratifying to report that a good many of these banks have already resumed business, and that the net mortality for the year is not expected to be anything like as large as had been prophesied.

This fact, and the advance in commodity prices are the two most salient and reassuring factors of the situation which seem to warrant a renewal of confidence in the future, and a distinct improvement in business between now and Christmas.

This improvement will not be promptly reflected in railroad earnings, as it takes time to get goods in shape for shipment from the manufacturer to the consumer, but of a distinct improvement in the demand there seems to be no doubt.

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THE BUSINESS WEEK

November 18, 1931

Amid the nervous swings of speculative sentiment in commodity and security markets, evidences of actual increase in industrial and trade activity so far in November are still slight, scattered and of uncertain significance . . . Despite undeniable improvement in underlying elements and more optimistic business attitudes it is unreasonable to expect much immediate evidence of upturn at this season of the year . . . Resistance to seasonal decline of steel production, fairly well sustained strength in residential building and carloadings, an October upturn in department store sales, scattered increases in employment, and some recession in currency circulation after allowance for seasonal and price factors, are all encouraging indications, offset by persistent weakness in electric power output and check payments and continued bank credit liquidation . . . Our index for the first week of November is stationary at the low level for the year . . . Commodity prices have relaxed the swift pace of their recent rise, and security markets have turned to them to set the tempo, lacking other stimulation in industrial or other news . . . Intensifying difficulties in the German financial situation, as yet unrelieved by French moves, as well as the economic uncertainties involved in the Manchurian picture of "raging peace," are some of the more immediate obstacles still to be overcome before the bear market can be definitely declared dead and the sacred, badly scared bull safely issue from his long seclusion for the next festival.

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Material Trends and Prices . . . .

Inquiry is even more active than a week ago in rods, sheets, strips, automotive parts, castings, and locomotive steel. Brisk trading continues in lead but stagnation is apparent in copper, tin, zinc and other non-ferrous metals. Solder, as an exception, is up about ⅛c. per lb. at New York. Brass rods, following certain of the raw metals, dropped ¼c. per lb., to 10¾c., base, during the week.

(All prices as of Nov. 13, 1931)

IRON AND STEEL

Pig Iron —	Current	Mo. Ago	Yr. Ago
Birmingham, No. 2, Fdry., per gross ton	$11@$12	$11@$12	$14.00
Buffalo, No. 2, Fdry., per gross ton	17.00	17.00	15.45
Heavy Melting Steel Scrap — Pittsburgh consuming point, No. 1, per gross ton	10.00	10.25	13.00
Furnace Coke — Connellsville, per net ton	2.40	2.40	2.60
Foundry Coke — Connellsville, per net ton	3.25	3.25	3.50
Steel Shapes — Pittsburgh, base, per 100 lb.	1.60	1.60	1.60

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Iron Machinery Castings — Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight, 275 lb.:

Chicago....4.62½ Cleveland....4.50 New York....4.75
Cincinnati....4.35 Detroit....4.00

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Steel Sheets — Prices in cents per lb., del. from warehouse stock (except at Pittsburgh) in lots of 401 to 999 lb., ordered and released for shipment at one time:

	Pitts. Mill	Chicago	Cleveland	New York
Blue annealed, No. 10	1.85	3.20	3.00	3.40
Black sheets, No. 24	2.40	3.55	3.60	3.50
Galvanized, No. 24	2.90	4.10	4.00	4.00

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Seamless Steel Tubing — Cold-drawn mechanical tubing, round, .10 to .30 carbon, in lots of less than 100 ft. or 100 lb., net, at N. Y. warehouse:

Thickness of Wall		Outside Dia. in Inches						
		½	⅝	¾	⅞	1	1¼	1½
Inches	B.w.g.	Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23

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Shapes, Plates, Bars, Etc. — Warehouse base prices in cents per lb., del. in lots of 401 to 999 lb., ordered and released for shipment at one time:

	New York	Cleveland	Chicago
Bands	3.40	3.00	2.95
Bars, soft steel	3.10	2.75	2.75
Cold fin., flat or square	3.90	3.60	3.60
Cold fin., round or hexagon	3.40	3.10	3.10
Cold rolled strips	4.95	6.00	5.50
Floor plates	4.85	5.00	5.00
Hoops	3.75	3.65	3.50
Rivets	4.00	4.00	4.00
Shapes	3.10	2.95	3.00
Spring steel	4.00	4.00	4.00
Tank plates	3.10	2.95	3.00

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Stainless Steel — Hot-rolled bars, base, Pittsburgh. 0.12 per cent carbon, cents per lb.:

Chromium		Chromium	
15% and under	19.00	18 to 23%	23.00
15 to 18%	20.50	23 to 30%	28.00

Bolts and Nuts — Discount from list, f.o.b. mills, Birmingham Chicago, Cleveland and Pittsburgh, on machine bolts, all sizes, cut thread; nuts, hot-pressed or cold punched; and lag screws, mill lots 73-10%

NON-FERROUS METALS

Prices following are in cents per lb. for mill shipments in carlots:	
Aluminum ingots 99%, N. Y.	23.30
Copper, electrolytic, Conn.	7.00
Copper wire, base, Chicago and Cleveland	9.37½
Copper wire, base, N. Y.	9.25
Lead, pigs, E. St. Louis	3.90
Tin, Straits, pigs, spot, N. Y.	23.00
Zinc, slabs, E. St. Louis	3.25
Prices following are in cents per lb., base, N Y., Chi. and Cleve.:	
Brass rods, high	10.75
Brass sheets, high	13.00
Brass tubing, high	16.25
Copper, drawn round	13.62½
Copper sheets	16.12½
Copper tubing	15.62½
Prices following are in cents per lb., del. from N. Y. warehouse:	
Babbitt, anti-friction, general service	28.50
Babbitt, com'l, intermediate grade	34.25
Babbitt, genuine, highest grade	43.00
Solder, bar	18.25
Prices following are in cents per lb., base, Huntington, W. Va.:	
Monel metal rods, hot rolled	35.00
Monel metal sheets, full finished	42.00
Monel metal tubing, seamless	65.00
Nickel rods, hot rolled	45.00
Nickel sheets, full finished	52.00
Nickel tubing, seamless	75.00

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Scrap Non-Ferrous Metals — Dealers' purchasing prices in cents per lb., f.o.b. cars:

	New York	Cleveland	Chicago
Heavy yellow brass	2.75	2.50	2.25
Light brass	2.25	1.75	2.00
No. 1 rod-brass turnings	3.00	2.75	2.50
Heavy copper	5.25	4.50	4.00
Light copper	4.25	3.75	3.50

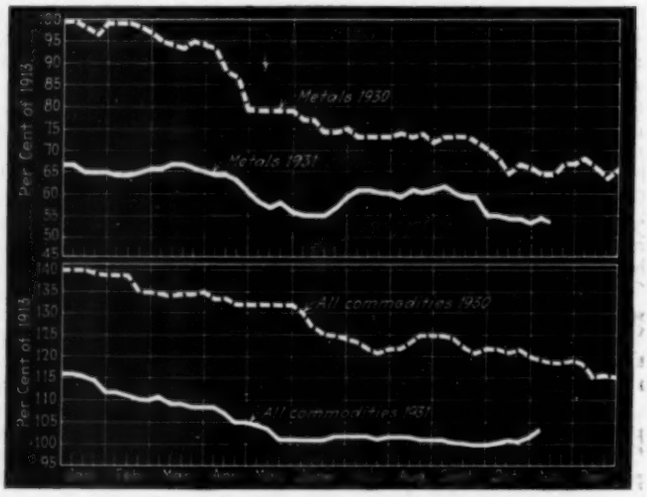
SHOP SUPPLIES

(Prices at warehouse)	New York	Cleveland	Chicago
Abrasive disks, aluminum oxide No. 50 grain, cloth, 6-in. dia., X weight, per 100	$4.37	$4.59	$4.59
Belting, leather, heavy	30-10%	40%	40%
Belting, rubber, trans., Grade 1	60-10-10%	60-10%	60%

Lumber — Per M ft., b.m., 12-16 ft. lengths, delivered, N. Y.:

Crating — Southern pine:
1x4-in. ..... $27.00 1x6-in. $26.00

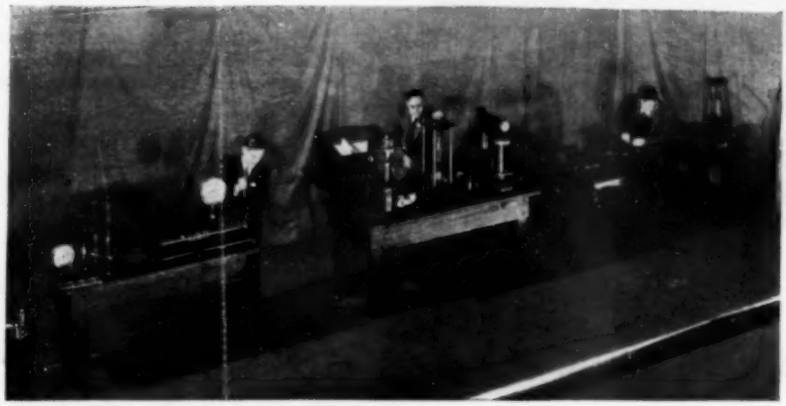
Skids—Spruce:
2x4-in. ..$37.00 3x4-in. .$40.00 4x6-in. .$42.00 6x6-in. .$50.00



Price Movements Week by Week

Average Price of Raw Metals: Pig Iron, Billet Steel, Copper, Tin, Lead, Zinc—American Machinist
Seventy-Four Commodities Index—The Annalist

NEWS



International Acetylene Association Stages Testing Demonstration

Outstanding in educational value and overshadowing other sessions in points of interest and attendance was the weld test demonstration given before the 32nd annual convention of the International Acetylene Association, in Chicago, Nov. 11 to 13. No professional body could have put on a better-timed show than the welding tests dramatized by JOHN J. CROWE, Air Reduction Laboratories, Inc., and DR. A. B. KINZEL and W. B. MILLER, engineers of the Union Carbide & Carbon Research Laboratories, Inc. On the stage in front of an audience of over a thousand, with every available type of modern testing equipment and in regular order, the demonstrators went through the tests and following each threw on the screen slides or slow-motion pictures illustrating the details to those in the farthest corners of the room. These demonstrations included visual inspection; the hammer and anvil nick break test with fracture examination; the free bend test to determine the ductility of the weld by direct measurement of the elongation of its outside fibers after bending; the well-known tension test in a portable hydraulically-actuated pulling machine; Brinell and Rockwell hardness tests, the A.S.M.E. specific gravity test for unfired pressure vessel welding; the stethoscope test wherein the ring of the plate when tapped by a hammer reveals the soundness of the weld; compression and tapered drift tests for welded tubing; and hydrostatic tests on welded bottles. Illustrated by slides were the latest methods of non-destructive tests by X-rays and gamma-rays emanating from radium.

Preceding these demonstrations were two talks along the line of training men in welding technique, one by DR. F. LEWIS LAND, educational director, Heating & Piping Contractors' National Assn.; the other by THOMAS M. JONES, superintendent of welding, Illinois Steel Co. A paper on the growing importance of tests and its meaning to the welding industry, prepared by DR. H. L. WHITTEMORE, Bureau of Standards, in his absence was read by PROF. COMFORT A. ADAMS of Harvard University, and director, American Bureau of Welding.

Professor Adams also addressed the afternoon meeting, and in doing so departed from his topic of "Welding and Its Future" to discuss present economic conditions in which he revealed himself as a single-tax advocate and a disciple of Henry George. Before launching into a criticism of our present system, he emphasized the necessity of the further application of scientific analysis and investigation in the way of fundamental research as an aid to the welding industry. What started Professor Adams off his assigned subject was the keynote address on "Business Prospects for 1932," given by BERNARD J. MULLANEY, vice-president of the Peoples Gas Light & Coke Co., of Chicago. Mr. Mullaney assuming a typical *laissez faire* attitude, denounced with considerable vehemence all PLANS and expressed unbounded confidence in America pulling itself out of its present hole without the aid of "crutch legislation." Commenting on the "best advertised depression we have ever had," he voiced the opinion that the tide has turned.

Perhaps Professor Adams was led to depart from his set subject by the example set by IRVING B. HEXTER, of "Industry and Welding," who passed off with a single sentence welding operations on the U. S. airship "Akron," and launched into a vivid description of the Queen of the Air. Other papers were devoted to pipe welding, welding in the chemical industry, and welding education. In fact, welding education may be said to have been the keynote of the entire convention.

Officers elected for the coming year are: President, W. C. KEELEY, JR., National Carbide Corp., New York City; vice-president, E. J. HAYDEN, Linde Air Products Co., Chicago; secretary, H. F. REINHARD, J. B. Colt Co., New York City; treasurer, W. E. COTTER, Union Carbon & Carbide Co., New York City.

Dr. H. C. Parmelee Elected McGraw-Hill Vice-Pres.

DR. H. C. PARMELEE, editorial director of the McGraw-Hill Publishing Co., publisher of *American Machinist*, has been elected a vice-president. The election follows Dr. Parmelee's successful administration of his duties as editorial director since his appointment three years ago.

Dr. Parmelee has been editorial director of the McGraw-Hill publications

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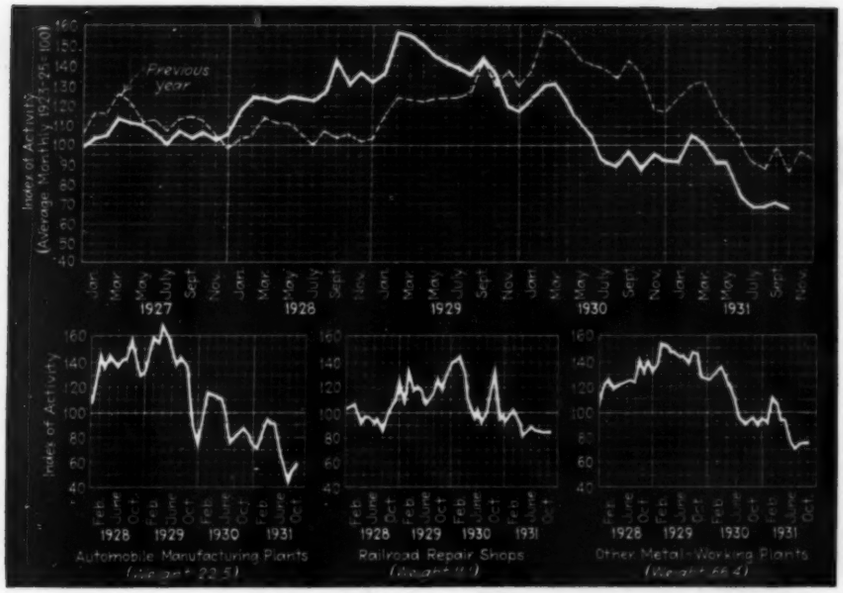
since 1928. Prior to that he was editor of *Chemical and Metallurgical Engineering*, from 1919 to 1928. He was graduated from the University of Nebraska in 1897. For some years he was employed as a chemist around Denver, establishing his own consulting office there in 1902. He entered editorial work in 1905, and joined *Chemical and Metallurgical Engineering* in 1910 as western editor. He was elected president of the Colorado School of Mines in 1916, and returned to McGraw-Hill in 1917.



October Metal-Working Operations Show Slight Decline

A slight decline in general metal-working activity is indicated by the reports on consumption of electrical energy for power purposes, contrasting with a slight rise last month. The final figure for October was 69.4, as compared with 71.2 in September, 68 in July and August, 78.2 in June, 89.1 in May, 92.4 in April, and 100.3 in March. These figures are all adjusted for 26 working days, as are subsequent ones.

The automobile shop index, 94.1 for March, 90.8 for April, 91.5 for May, 71.3 for June, 55.9 for July, 43.6 for August, and 53.7 in September, rose three points to 57.4 in October. The railroad repair shop index, 94.3 for March, 82.8 for April, 84.7 for May, 89.2 for June, 84.3 for July, 85.5 for August, and 84.0 for September, rose slightly to 84.5 for October. Ferrous and non-ferrous metal-working plants outside these two groups had a March index of 100.5, an April index of 94.6, a May index of 94.1, a June figure of 78.6, a July figure of 69.3, an August index of 73.3, and a September figure of 75.0, dropping slightly to 71.0 in October.

When the figures are adjusted for seasonal variations, slight revisions occur. The railroad repair shop index rises to 85.5, and the metal-working index rises to 72.5, while the automobile index drops to 55.4. Railroad repair shop seasonally adjusted indexes were, in previous months, September 87, August 96.2, July 92, June 96, May 92.5, April 80.1, March 90.3. Similar automobile indexes were, September 52, August 45.3, July 56.3, June 69.8, May 78, April 76, March 88.2. Similar figures for other metal-working plants are, September 76, August 79.3, July 73.5, June 82.8, May 91.7, April 92.4, March 95.3. These give a seasonally adjusted figure for the entire group of 70.1, down two points from the 71.9 of September and four from the 73.5 of August. The July figure was 71.7, June 81.4, May 87.3, April 87.9, and March 92.9.

A.F.A. 1932 Show In Philadelphia

The 36th annual convention and exhibit of the American Foundrymen's Association will be held in Philadelphia, May 2-6, 1932, according to a recent announcement, all convention and exhibit activities being centered in the new Municipal Convention Hall, 34th St. & Vintage Ave. Tentative plans for 1932 program include a number of practical shop operations and round-table sessions. For exhibit purposes, two large halls are available, one the arena or auditorium and the exhibition hall proper. Complete power facilities include alternating and direct current, gas, compressed air, hot and cold water and live steam. A siding of the Pennsylvania Railroad supplies freight handling facilities.

Welding Conference Held in Minneapolis

The Northwest Chapter of the A.S.S.T., in cooperation with the Manufacturers' Association of Minneapolis, is holding a welding conference there today, tomorrow and Saturday. Included in the papers to be presented are "New Code for Welded Pressure Vessels" by STUART PLUMLEY, chief engineer, Smith Welding Equipment Corporation; "Testing of Welds" by F. G. OUTCALT, resident engineer, Linde Air Products Co.; "Hard Surfacing," also by Mr. Plumley; "Automatic Welding" by WILLIAM B. BRADY, district arc-welding specialist of General Electric Co.; "Recent Developments in the Welding Industry and the Opportunities They Present to Trained Operators" by L. C. MONROE of *The Welding Engineer;* "The Shielded Arc, Both Manual and Automatic" by G. O. FORSETH, district manager, Lincoln Electric Co.; "Bronze Welding and Cutting" by A. F. HUNA, Applied Engineering Department, Air Reduction Sales Co.; "Shop Welding of Machinery" by W. W. REDDIE, manager Welding Section, Westinghouse Electric & Mfg. Co.; "Lindewelding—A New Technique of Pipe Welding," by F. G. OUTCALT.

Foundry Cost Manual Available Now

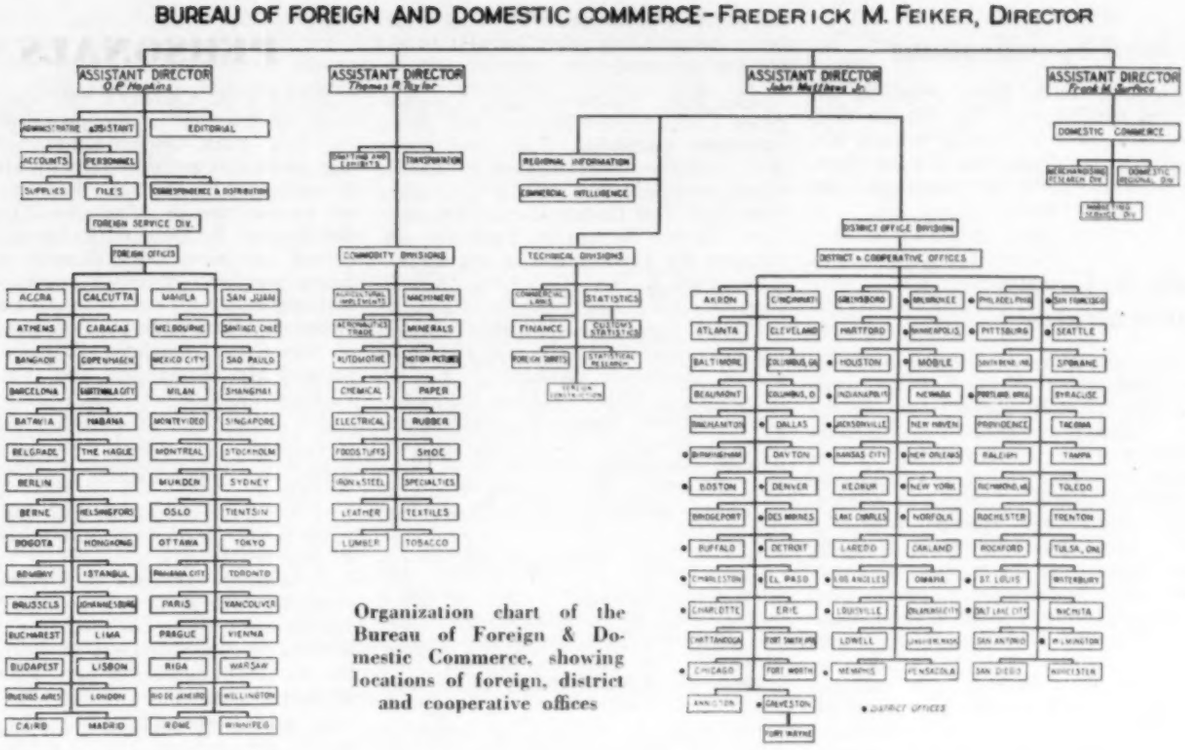
During the past two years, a new technique and procedure in steel foundry accounting and cost methods has been developed by the Steel Founders' Society of America, Inc., the principles of which are definitely outlined in a printed loose-leaf cost manual available to all foundries. While a general layout of accounts and cost methods are covered in the uniform cost manual, a series of supplements are to be prepared describing more in detail the proper manner in which to handle various elements of cost procedure. The first of these supplements covers the structure and method of using a recently designed standard estimate form which ties in with and conforms to the uniform cost plan.

Engineers Set Up Employment Bureau

Members of the four National Engineering Societies, the A.S.C.E., A.I.M.E., A.S.M.E., and A.I.E.E., have organized a committee to help those of their members and other professional engineers who are in need because of unemployment. The committee is to find employment for professional engineers and to give financial aid to those in actual need of relief. It is headed by H. DE B. PARSONS as chairman, and functions through an executive committee, of which JOHN P. H. PERRY is chairman, a Finance Committee, and a Relief Committee. Headquarters are in the Engineering Societies' Building, 29 West 39th St., New York City.

Specifications

Recent proposed Federal specifications include a revision of No. 580 for 300-lb. malleable iron or steel unions, and No. 269a for non-ferrous welding rods for gas welding.



Organization chart of the Bureau of Foreign & Domestic Commerce, showing locations of foreign, district and cooperative offices

French Industry Shows Further Decline

By Our Paris Correspondent

Falling prices of British products on the French market and increasing difficulty in selling French goods in England, coupled with the possible advantage which will accrue to Germany by reason of this unlooked for situation, is again stalling French optimism, except such as is likely to be born from Premier Laval's visit to President Hoover.

Emphasis to this has been given by the almost immediate falling off of luxury exports from France to Great Britain, though the drop had already been making itself felt. For example, French automobile exports to Britain fell in value from 129,700,000 francs in 1928 to 74,000,000 francs in 1930.

The Metropolitan Section of the great Colonial Exposition displayed very little production machinery. The chief items were mine extraction machines, textile machinery, road building appliances, printing machinery and but a limited number of metal-working and wood-working machine tools.

The keystone of the French metal transforming industries is the automobile. Its present situation does not indicate the progress looked for. Late figures, made available at the annual automobile salon, indicate last year's consumption of steel as 130,000 metric tons for motors and chassis and 160,000 tons of steel sheets for body work, with 3,000 tons of bronze and copper and 5,000 tons of other metals. 510,000 are employed in the industry, which puts it in the second rank of employers, immediately after railway transportation (550,000) and far ahead of coal mining, which is third with 330,000.

Last year's production, 230,760 cars, actually 15,000 fewer than in the year previous, was valued at 6,250,000,000 francs, a drop of 250,000,000 francs from the year before. The government taxes the automobile industry and the usage of motor cars an annual sum of 3,773,000,000 francs, more than the country's profits from the entire post and telegraph services.

Three French automobile makers are making strenuous effort to get into big production with two small car propositions—Citroen with an 8 hp. rating, at approximately $900, Mathis with an Americanized motor, rated here at 7 hp., for rather less than $800, while Renault has a 7 hp. at a similar price. Given their small fuel consumption, their low taxation and their general efficiency and completeness it is believed in some quarters that this is the only means of stimulating comparatively big scale output for the coming year. Certainly the just closed annual Auto-Salon gave little indication of an awakening in the industry otherwise.

The chief new developments in the 1931-32 automobile exhibits were undoubtedly in chassis construction, following once again American methods. Trapezoidal chassis were shown in considerable numbers. Every effort appears to have been made to increase strength and resistance to stress and at the same time curtail weight. Stiffened body work in improved form was also a feature.

The general situation is automatically registered by the very definite barometer markings of economic indices. Obviously no boom, no great general improvement and no considerable projects for machine equipment for the future are to be envisaged until the turmoil of the financial, economic and political world again returns to normal.

Recently the general trade index of 100, as of 1914, stood at 437, with national products at 504 and imported products (in which raw materials play a large part) 316. Minerals and metals and their manufactures stood at 382. Retail prices fell to 588 as compared with 615 in July.

National Safety Council Provides Insurance

Carl W. Bergquist, president of the National Safety Council, has announced that its employees are to be protected by approximately $265,000 of group accident and health insurance through a contract with The Equitable Life Assurance Society. The organization and the employees will share in paying the cost of the insurance. The contract provides a total weekly indemnity of $2,250, graduated from $10 to $40 a week for individuals, in cases of disability resulting from sickness or non-occupational accidents. Benefits are limited to twenty-six weeks for one disability.

Federal Specifications

Revisions have been proposed for Federal specification No. 436 for dividers, No. 488 for drawing knives, No. 418 for nail pullers, No. 474 for plumbers ladles, No. 484 for trowels and No. 435 for glass cutters.

Yale & Towne Concentrates

The entire Materials Handling Equipment Department of the Yale & Towne Mfg. Co. is now concentrated at the new Philadelphia plant. The manufacturing of three different types of materials handling equipment, hand and electric chain hoists, overhead conveying systems and electric industrial trucks, two types of equipment formerly manufactured at the Stamford, Conn. plant, and the StueBing line of hand lift trucks, formerly made at the Cincinnati, Ohio and Holyoke, Mass. plants, are now concentrated at Philadelphia. The new plant extends over an area of approximately 4 acres and comprises 22 individual buildings. All machining and assembling is done on a single floor in the building known as No. 14.

BUSINESS ITEMS

The Universal Gear Sales Corp., Indianapolis announces a Detroit representative, H. E. PAYNE, with offices at 337 Curtis Bldg., 2842 W. Grand Blvd. This company makes heliocentric and variable speed reducers, cutters and couplings.

The Louisville & Nashville Railroad Co. has ordered $1,000,000 worth of steel rails from the Tennessee Coal, Iron & Railroad Co.

The National Utilities Co. has been authorized at Milwaukee to take over the production, sales and business of the National Utilities Corp., former affiliate of the National Brake & Electric Co. EDWARD F. STIEMKE is president. Headquarters are at 5425 W. State St. Water pumps and complete units of the deep-well pneumatic type will be manufactured.

The Barrows Lock Works, Lockport, Ill., has been closed and its equipment and machinery is being transferred to the Sager Lock Works, Chicago, according to an announcement by WILBUR HARPHAM, assistant superintendent. The plant, which has been in existence for the past forty years, has employed as high as 250 workmen, but in recent months the force has been reduced to 80.

Approval of the sale of the Winchester Repeating Arms Co. at auction, with $4,000,000 as the minimum bid, was given recently in the United States District Court. An offer to purchase the property has been made by the Western Cartridge Co., headed by P. W. OLIN, as previously announced. The Court order permits any other interest to bid for the property.

The Tool Equipment Co., Los Angeles, Calif., headed by HENRY F. JURS, has been dissolved. For many years this company was exclusive Pacific Coast representative of the Geometric Tool Co., New Haven, Conn. Effective Nov. 1, the Geometric Tool Co. announces the appointment of the Drake-Grau Tool & Mfg. Co., Ltd., 1520 E. Slauson Ave., Los Angeles, Calif. as exclusive agent for Geometric threading machines, die heads, taps and chasers in Southern California. C. W. Marwedel of 11th and Alice Sts., Oakland, California, handles Geometric products in Northern California, as previously announced, and the J. C. Ross Co., 2719 First Ave., Seattle, Wash., is exclusive agent in Washington and Oregon.

The Foster Wheeler Corp., 165 Broadway, New York, has opened a branch office in Washington, D. C., at 726 Jackson Place, Northwest. J. S. MALSEED has been transferred from New York to be in charge of the new office.

The American Institute of Weights & Measures will hold its annual meeting at its headquarters, 33 Rector St., New York City, on Dec. 2.

Plastics Industries, Inc., Lincoln Bldg., New York has moved its offices to its Newark plant at Roanoke Ave. and Foundry St., Newark, N. J.

It is reported that a strong industrial group is completing arrangements for the formation of an all-Canadian car company, specializing in the leasing of tank cars. The reason for the development is that the Dominion Railway Commission has ruled that after April 30, 1932, tank cars should be owned or leased by shippers, and no longer supplied by the railways themselves. It is understood that the new company will be closely affiliated with the Canadian Car & Foundry Co.

The Automatic Products Co. and the National Machine Products Co., both of Detroit, Mich., have been licensed by the Dardelet Threadlock Corp., 120 Broadway, New York, N. Y., to manufacture bolts and nuts, capscrews, setscrews and studs threaded with the Dardelet self-locking screw thread.

Plants of the Forse Equipment Co. and the Forse Mfg. Co., Anderson, Ind., are unusually busy, officials state. The Forse Equipment Co. is making a new type of automatic air-operated laundry press and cleaning press and is a month behind in its orders. Recently the company equipped several laundries in Chicago.

The C-A Mfg. Co. and the Adjustable Bearing Co., both of Indianapolis, are planning to move to Crawfordsville, Ind. C. A. MARIS is president of both companies. The former makes woodworking tools, while the latter makes automobile bearings.

PERSONALS

PATRICK E. CROWLEY, 67, who rose from telegrapher to the presidency of the New York Central Lines, will resign from that position Jan. 1. He will be succeeded by FREDERIC E. WILLIAMSON, now president of the Chicago, Burlington & Quincy Railroad, who served the New York Central for 27 years and who obtained much of his training under the administration of Mr. Crowley. RALPH BUDD, now president of the Great Northern Railway, will succeed Mr. Williamson, and WILLIAM P. KENNEY, vice-president in charge of traffic of the Great Northern, will probably succeed Mr. Budd. Mr. Crowley, who will have completed 42 years of service with the N.Y.C. Jan. 1, and who has been connected with the railroads for 53 years, will devote his time to private interests, although he will remain with the railroad in a consulting capacity. He is best known as "Pull Eighty Cars" from his insistence, when a division superintendent in 1901, that the maximum number of cars be carried by each train.

WILLIAM K. ANDREWS, for the past ten years production service engineer with the Kearney & Trecker Corporation, Milwaukee, Wis., has resigned to join the Davis & Thompson Co., 57th Ave. and Mitchell St., Milwaukee, manufacturer of large, high-production, continuous milling and drilling equipment.

GREGORY J. COMSTOCK, director of research, Firth-Sterling Steel Co., McKeesport, Pa., presented a talk before the New Jersey Chapter, A.S.S.T., Nov. 4 on the manufacture of cemented hard carbide materials.

D. W. DEAN, general engineer of the steel mill engineering department, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., addressed the Philadelphia Section of the Association of Iron & Steel Electrical Engineers, Oct. 31 on "Application of Non-Radio Vacuum Tubes in the Steel Industry."

L. W. ERICKSON has been placed in charge of a new district office in Milwaukee of the Foote Bros. Gear & Machine Co., 215 North Curtis St., Chicago, and the new office is at 231 Wisconsin Ave., Room 1418 Majestic Bldg. Mr. Erickson has been connected with the W. A. Jones Foundry & Machine Co. for the past several years, serving in the general engineering, estimating and sales departments in the Chicago, New York and Buffalo offices.

R. L. GRAY, vice-president and general manager of the Sheffield Steel Corp., Kansas City, Mo., since its organization in 1925, has been elected president. He was formerly vice-president of the Kansas City Bolt and Nut Co., predecessor to Sheffield Steel, and came to that company in 1923 when the management was taken over by W. L. ALLEN as its president. Mr. Allen has been elected Sheffield's chairman of the board.

HUGO CZERWONKY has been appointed advertising manager of the Kearney & Trecker Corp., Milwaukee, to succeed C. M. CHEADLE, who resigned recently to engage in a new business distributing a line of sanitation systems.

WILLIAM H. JACOBI, formerly general manager of the Keokuk (Iowa) Steel Casting Co., subsidiary of the Springfield (Ill.) Boiler Co., is now affiliated with the Continental Roll & Steel Foundry Co., East Chicago, Ind., in the capacity of sales engineer, specializing in cast steel pressure vessels and fittings of all kinds.

C. A LIDDLE, president of the Pullman Car & Mfg. Corp., Chicago, has been elected president of the Standard Steel Car Co., a subsidiary, succeeding P. H. JOYCE, who becomes chairman of the board.

EUGENE F. LENOIR, formerly president and general sales manager of the Union Electric Manufacturing Co. of Milwaukee, Wis., has joined the Allen-Bradley Co., Milwaukee, as a special representative to contact motor manufacturers.

F. C. MILLER, formerly connected with the Allis Chalmers Mfg. Co., Milwaukee, Wis., has resigned to rejoin the Four Wheel Drive Auto Co., Clintonville, Wis., as a member of the sales engineering staff.

DONALD J. REESE, metallurgical engineer of the Whiting Corporation, Harvey, Ill., spoke before the Pittsburgh Foundrymen's Association, Nov. 16, on "The Making of High-Test and Alloy Gray Iron in the Brackelsberg Furnace." This furnace was discussed in *American Machinist* on page 519, Vol. 75.

O. M. REIF, vice-president of the Harbison-Walker Refractories Co., Pittsburgh, who retired several years ago from active management, has resigned. P. B. MOSSMAN has been elected a director and vice-president of the company in charge of finance. Mr. Reif will remain on the board of directors.

DONALD M. SCOTT, former vice-president of the Gould Coupler Co., has been elected a vice-president of the Buffalo Electric Furnace Co. THOMAS H. NELSON of the Midvale Steel Co. and DR. GILBERT E. SEIL of E. J. Lavino & Co., Philadelphia, have been added to the Buffalo Electric Furnace engineering staff.

PATRICK H. JOYCE, president of Standard Steel Car Co., Chicago, who has been acting president of the Chicago Great Western Railroad since last July, has been elected president.

DR. CALVIN W. RICE, secretary of the A.S.M.E. for the past 25 years, will be made an honorary member at the coming annual meeting in New York, Nov. 30 to Dec. 4.

DR. ELIHU THOMSON, director of research of the Thomson Laboratories, General Electric Co., and PROF. DUGALD C. JACKSON, head of the electrical engineering department of the Mass. Institute of Technology, spoke in observance of the Michael Faraday Centenary at the Engineering Societies Bldg., 29 W. 39th St., New York City, recently.

JOSEPH E. SWENDEMAN has leased space and installed machinery in Orange, Mass., for the manufacture of the Swendeman steam trap and other steam specialties.

DR. S. WATANABE and K. SHIBATA, associated with the Nippon Tokushuko Kaisha (Japan Special Steel Co.), Omori, Tokyo, accompanied by S. K. TATEYAMA, are spending several weeks in this country making contacts and visiting steel plants. This company specializes in tool steels.

H. L. WHEELOCK, for 20 years identified with the Superior Brass Foundry, 84 Eleventh St., Waterloo, Iowa, has disposed of his interests to his partner, C. H. HARMON, and will retire from active business. The factory manufactures brass and aluminum castings and was established a quarter of a century ago by the late WILLIAM F. BAUM.

C. WALTER YOST, superintendent of foundries of the Midvale Co., Nicetown, Pa., lead a discussion on the operation of the cupola, calculation of cupola mixtures and analysis for classes of testings at the Philadelphia Foundrymen's Association meeting November 11.

GEORGE W. ZWEIFEL, for several years sales engineer with the Detroit-Star Grinding Wheel Co., Detroit, has severed his connection to engage in business under the firm name of George W. Zweifel & Son, with headquarters at 103 Security Bldg., Portland, Ore., to specialize in sales engineering and to introduce new devices and tools for practical manufacturing purposes.

OBITUARIES

BRUCE C. DAVEY, SR., 40, vice-president of the Denver (Colo.) Equipment Co., died in Chicago recently.

HENRY G. BECHTOLD, for almost 40 years a superintendent of the Cleveland (Ohio) Frog & Crossing Co., died Nov. 8. As a young man Mr. Bechtold worked for several years for the Pennsylvania railroad as locomotive fireman. In 1880 he was employed by the Modern Frog & Crossing Co. Following this connection he returned to railroading as a locomotive engineer and later became general foreman of engines at the Huntington shops of the Chicago & Eastern railroad, now the Erie. In 1892 he returned to the Cleveland Frog & Crossing Co. as a superintendent.

LEON C. DECKARD, Northern Pennsylvania representative located at Erie, of the Barney Machinery Co., Inc., Koppers Building, Pittsburgh, Pa., died suddenly Nov. 1, of heart failure. He had been connected with the company for the past six years.

WALTER S. ESSICK, 68, inventor of many mechanical devices, died at his home at Reading, Pa., Nov. 7.

COLUMBUS HAILE, 71, for 40 years an employee of the Missouri, Kansas & Texas Railroad and until his retirement last October its president for four years, died in St. Louis, Nov. 14, after an illness of several months.

CHARLES D. HEALD, 46, director of the City Engineering Co., Vacuum Tool Co. and the Seifreat-Elsted Co., Cincinnati, died Nov. 8 at his home in Oakwood, O., a suburb of Dayton.

LOUIS G. HENES, 50, president of the Henes-Morgan Machinery Co., San Francisco and Los Angeles, Calif., died in New York, Nov. 1. He had been in ill health for some time. Mr. Henes was first connected with the Pratt & Whitney Co. and later with Harron, Rickard & McCone in San Francisco. He organized the Louis G. Henes Machinery Co. in 1915, which this past summer became the Henes-Morgan Machinery Co.

PHILIP A. KOEHRING, president of the National Equipment Corp., Milwaukee, and founder of the company in 1910, died recently.

COL. ISAAC NEWTON LEWIS, 73, who invented the first portable air-cooled machine gun, dropped dead of heart disease Nov. 8, at Hoboken, N. J.

WILLIAM LOUDEN, 90, for 60 years prominent manufacturer in Fairfield, Iowa, died Nov. 5 in his home after a brief illness. He was founder of the Louden Machinery Co., maker of hay tools and farm equipment. Mr. Louden was owner of title in 118 patents on farm implements.

JOHN W. MCKEE, assistant treasurer of the National Tube Co., Pittsburgh, died November 7 in his home at Dormont, Pa.

THOMAS SPENCE, 81, president of the Rundle-Spence Mfg. Co., Milwaukee, Wis., died recently after a six-week illness. He acquired his interest in the firm in 1871.

MEETINGS

NATIONAL FOUNDERS ASSOCIATION
Thirty-fifth Annual Convention, Hotel Astor, New York City, Nov. 18-19. J. M. Taylor, secretary, 29 South La Salle St., Chicago, Ill. Eastern Office, 5633 Grand Central Terminal Bldg., New York, N. Y.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Annual meeting, Engineering Societies Bldg., New York, N. Y., Nov. 30-Dec. 5. Calvin W. Rice, secretary, 29 West 39th St., New York, N. Y.

TAYLOR SOCIETY
Annual Meeting, Hotel Pennsylvania, New York City, Dec. 2-4, Dr. H. S. Person, managing director, 29 West 39th St., New York, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS
Annual meeting, Book-Cadillac Hotel, Detroit, Mich., Jan. 25-29. John A. C. Warner, secretary, 29 West 39th St., New York, N. Y.

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Opportunities for Future Business

Calif., San Gabriel—Eastern Airplane Mfg. Co., having plans prepared for a group of buildings for airplane factory here. National Airport Engineering Co., 775 East Washington St., Los Angeles, Engr.

Ga., Atlanta—A. G. Candler, Inc., Candler Bldg., awarded contract for construction of a 1 story, 66 x 103 ft. garage building at Ellis St. and Carnegie Way. N. E.

Conn., Bridgeport—White Line Bus Corp., W. Sperry, Pres., 4490 Main St., will build a 1 story, 85 x 125 ft. addition to garage terminal. Estimated cost $50,000. L. Asheim, 211 State St., Archt. Work will be done by day labor. Noted October 15.

Conn., Bridgeport—Board of Education, preparing plans for a 3 story, 64 x 240 ft. school including manual training department at Thorne and Madison Ave. Estimated cost $650,000. Frederick J. Dixon, State St., Archt.

Conn., East Haven—Viking Flying Boat Co., c/o M. Linenthal, 250 Devonshire St., Boston, Engr., awarded contract for construction of a 1 and 2 story, 85 x 100 ft. airplane hangar and 25 x 100 ft. shop and office building, etc. Noted November 12.

Ia., Cherokee—State Highway Commission, E. W. Dunn, Dist. Engr., Sioux City, awarded contract for construction of a 1 story maintenance building in Dist. No. 3 here.

Ia., Corning—State Highway Commission, L. M. Martin, Dist. Engr., Council Bluffs, awarded contract for a 1 story maintenance building here. Noted September 24.

Ia., Des Moines — Interstate Transit Lines, 422 Grand Ave., awarded contract for remodeling bus depot at 5th St. and Grand Ave. Estimated total cost $50,000. Noted September 17.

Ia., Fort Madison—Iowa State Penitentiary, T. Hallowel, Warden, will build a 3 story, 50 x 200 ft. prison building including work shop. Estimated cost $60,000. Work will be done by convict labor.

Ia., Council Bluffs—State Highway Commission, L. M. Martin, Dist. Engr., will build a 1 story maintenance shop at Second Ave. and 20th St. Estimated cost $20,000.

Ia., Dubuque—Chicago-Dubuque Motor Transportation Co., will build a 1 story repair and service garage at Iowa and Third Sts. $15,000.

Ia., Grundy Center—Grundy County, G. L. Eggleston, Auditor, awarded contract for construction of two maintenance buildings.

Ia., Sioux City—Steffan Body Works, O. F. Steffen, Pres., 613 West 7th St., awarded contract for a 1 story, 75 x 103 ft. shop building Estimated cost $20,000.

Mass., Boston — M. Greenspan, 161 Devonshire St., will soon receive bids for altering terminal basement into garage at South Station. Estimated cost $40,000. Blackall, Clapp, Whittemore & Clark, 31 West St., Archts.

Mass., Boston—Northeastern University, 316 Huntington Ave., preparing tentative plans for an engineering building. Estimated cost $40,000. Architect not selected.

Mass., Cambridge (Boston P. O.)—J. L. Hammett Co., Kendall Sq., manufacturers of school supplies, awarded contract for a 2 story addition to factory. Estimated cost $40,000.

Mass., Cambridge (Boston P. O.)—Simplex Wire & Cable Co., 66 Sidney St., awarded contract for a 3 story addition to factory at 79 Sidney St. Estimated cost $40,000.

Mass., Chelsea (Boston P. O.)—Crescent Shoe Mfg. Co., 112 Crescent Ave., awarded contract for 1 story addition to factory. Estimated cost $40,000.

Mass., Lynn—North Shore Cutting Die Co., J. Hermanson, 898 Broad St., completed plans for a 1 story addition to factory. B. Porter, 209 Washington St., Boston, Archt.

Mass., Norfolk — Commonwealth of Massachusetts, Dept. of Correction, completed preliminary plans for construction of 1 story sheet metal shop (Factory No. 1) at Prison State Colony. Estimated cost $60,000. McLaughlin & Burr, 88 Tremont St., Boston, Archts.

Mass., Reading—Ace Art Co., L. Riley, Mgr., 12 Gould St., completed plans for 1 story addition to factory. Estimated cost $45,000. D. J. Abrahams, 260 Tremont St., Boston, Archt.

Mass., Saugus—The Pines River Terminal Co., G. H. Keyes, 51 Marion St., Charlestown, plans construction of a bulk oil plant, 150,000 gal. capacity at head of Pines and Saugus River here. Estimated cost $3,000,000.

Mass., Watertown—H. P. Hood & Sons, Inc., 500 Rutherford Ave., Charlestown, awarded contract for a 1 story service station on Pleasant St. Estimated cost $40,000.

Mich., Detroit—American Blower Corp., 6000 Russell St., plans construction of a 1 story fan factory on Tireman Ave. Private plans.

Mich., Hancock—City Council, W. Hoffenbacher, Clk., awarded contract for a 2 story, 14 x 54 ft. garage.

Minn., St. Paul—W. C. Kingsford, 1603 University Ave., plans a 1 story, 50 x 60 ft. repair and service garage at Roy St. and University Ave. $10,000. Alan C. Fleischbein, 442 Endicott Bldg., Archt.

Minn., Thief River Falls—Alfred J. Borry, awarded contract for a 1 story, 35 x 50 ft. repair and service garage. $10,000. Vulcanizing equipment will be installed.

Mo., Jefferson City—Missouri State Highway Commission, awarded contract for maintenance buildings, each 41 x 80 ft. at Brookfield, Hannibal, Platte City, Lexington, Warrensburg, Sedalia, Camdenton, Vienna, Fulton, Cassville, Ozark, Waynesville, Winona, and Jackson. Estimated total cost $66,683.

Mont., Wolf Point—State Highway Commission, R. D. Rader, Engr., Helena, awarded contract for a 1 story shop building here. $20,000. Noted September 17.

Neb., Scottsbluff — Stockfleth Chevrolet Co., plans construction of a 1 story, 50 x 70 ft. repair and service garage.

Neb., Shubert—Best & Son, plans to rebuild barrel manufacturing plant destroyed by fire.

N. J., Bloomfield—General Electric Co., Lawrence St., revising plans and will receive bids about December 15 for a 1 story addition to factory. Estimated cost $40,000. Private plans. Noted August 20.

N. J., Elizabeth—Elizabeth Lumber Co., M. Goldberg, 1057 East Grand St., receiving bids (extended time) for a 2 story factory. Estimated cost $40,000. J. Anderson, 251 North Broad St., Archt. Noted October 29.

N. Y., Jersey City—J. I. Kislack, Inc., 29 Journal Sq., plans construction of a repair and service garage at Tonnele Circle. Estimated cost $40,000. B-R Service Station, Inc., c/o owner, lessee.

N. J., Little Falls—Little Falls Laundry Co., Main St., will receive bids about December 1 for 2 story, 140 x 280 ft. garage and 1 story, 65 x 85 ft. laundry. Estimated cost $150,000. F. W. Wentworth, 140 Market St., Paterson, Archt. O. E. Goldschmidt, 110 West 40th St., New York, Engr. Noted November 5.

N. J., Somerville—P. C. Van Nuys, 1 West Main St., Archt., will receive bids about December 1 for a 2 story, 100 x 200 ft. garage and stores building for Owner, c/o Architect. Estimated cost $150,000. Noted October 8.

N. Y., Brooklyn—E. Burak, 220 Meeker Ave., will build a 100 x 140 ft. service garage at Meeker and Stewart Aves. Estimated cost $40,000. M. Klein, 65 Court St., Archt. Work will be done by day labor and separate contracts. Noted October 29.

N. Y., Brooklyn—M. H. Renken Dairy Co., 584 Myrtle Ave., is receiving bids for a 2 story service garage and storage building at Classon St. and Myrtle Ave. Estimated cost $40,000. Koch & Wagner, 32 Court St., Archts. Noted October 29.

N. Y., Brooklyn—Texas Corp., 135 East 42nd St., New York, awarded contract for a bulk station at Clinton St. Estimated cost to exceed $40,000.

N. Y., New York—Domenico Sabbatino, 1839 Sedgwick Ave., having sketches made for a 2 story, 100 x 164 ft. service garage and gas station at Sedgwick Ave. and 169th St. Estimated cost $40,000. DeRose & Cavalieri, 370 East 149th St., Archts.

N. Y., New York—A. Schraders' Sons, Inc., 400 Vanderbilt Ave., Brooklyn, plans construction of a 2 story, 75 x 108 ft. service garage at 28 Rose St. here. Estimated cost $100,000. William Shary, 22 East 17th St., Archt.

Pa., Glenshaw—Board of Education, Shaler Township, F. C. Koussman, Pres., will receive bids until November 27 for a 3 story elementary and high school including manual training rooms at Mount Royal Blvd. Estimated cost $200,000. Ingham & Boyd, Empire Bldg., Pittsburgh, Archts.

Va., Staunton — Standard Oil Co. of New Jersey, F. C. Bigley, Standard Oil Bldg., Baltimore, Md., having plans prepared for a 1 and 2 story bulk oil storage plant including garage, office and warehouse, etc., here. Estimated cost $50,000.

Wis., Wausau—Marathon Paper Mills Co., awarded contract for a paper mill unit.

Equipment Wanted

Calif., Mare Island (Sta. Vallejo)—Bureau of Supplies & Accounts, Navy Dept., Washington, D. C.—will receive bids until November 24 for motor driven engine lathes for Navy Yard here. Scheds. 6868 and 6876.

Calif., Sacramento—Board of Education, C. C. Hughes, Secy.—will receive bids until November 23 for vocational training equipment for machine shop, woodworking, auto mechanics and electrical departments.

D. C., Washington—Bureau of Supplies & Accounts, Navy Dept.—will receive bids until December 1 for two pneumatic hammers, chipping, heavy work, type B.

D. C., Washington—Bureau of Supplies & Accounts, Navy Dept.—will receive bids until November 24 for motor driven engine lathe for Navy Yard, New York and San Francisco. Sched. 6864.

Kan., Tribune—Tribune Mfg. Co., c/o Edward Skillman, Bartlesville, Okla., Mech. Engr.—equipped to do general machine work including reboring automobile cylinders and welding, wishes trade catalogs.

Mass., Billerica—Middlesex County Commissioners, Court House, East Cambridge—will receive bids until December 1 for machine shop equipment, including small tools, turning lathe, manufacturing machines, band saws, saw bench, ball bearing planer, etc., for House of Correction here. Former bids rejected.

Mass., Boston—H. M. Lobdell, 130 Broad St.—lathe and screw cutting machine.

Mich., Mount Clemens — Cadillac Tool Co., 150 Grand Ave.—equipment for tool and die shop for heavy work.

Mo., St. Louis—E. L. Johnson, 3630 Olive St.—small screw cutting lathe, 8 to 10 in. swing.

Pa., Philadelphia—Bureau of Supplies & Accounts, Navy Dept., Washington, D. C.—will receive bids until Nov. 24 for motor driven engine lathe for Navy Yard here.

Tex., Schertz—Turner-Rand Gravel Co.—prices and data for machinery and forms for the manufacture of sewer pipe and concrete drain.